

Specifications & characteristics

The following tables list the performance specifications and operating characteristics for the Agilent Technologies 54835A/45A/46A oscilloscope. Asterisks (*) denotes warranted specifications, all others are typical. Specifications are valid after a 30 minute warm-up period, and within $\pm 5^\circ\text{C}$ from the self-calibration temperature.

Acquisition

Maximum Sample Rate	Real Time	Agilent Models 54835A — 2-channel mode: 4 GSa/s 54835A — 4-channel mode: 2 GSa/s 54845A — 2-channel mode: 8 GSa/s 54845A — 4-channel mode: 4 GSa/s 54846A — 2-channel mode: 8 GSa/s 54846A — 4-channel mode: 4 GSa/s
Maximum Effective Sample Rate	Equivalent Time	500 GSa/s
Memory Depth	2-channel mode: 65,536 points 4-channel mode: 32,768 points	Agilent 54835A, Agilent 54845A, and Agilent 54846A
Memory Depth Modes	Auto	Optimized for best combination of update rate and display quality.
	Manual	Selectable 2-channel mode: from 16 to 65,536 points 4-channel mode: from 16 to 32,768 points
Sampling Modes	Real Time	Successive single shot acquisitions.
	Equivalent Time	Random repetitive sampling (higher time resolution at fast sweep speeds).
Filters	9-bit Bandwidth Limit filter: $BW = (\text{Sample Rate})/20$	
	(Sin x)/x Interpolation: On/Off selectable FIR digital filter. Digital signal processing adds points between acquired data points to enhance measurement accuracy and waveform display quality. $BW = \text{Sample Rate}/4$	
Averaging	Selectable from 2 to 4096.	

Vertical

Number of Channels	4 (simultaneous acquisition)	
Bandwidth	Analog Bandwidth (-3dB)*	50Ω: 1.0 GHz — Agilent 54835A 50Ω: 1.5 GHz — Agilent 54845A 50Ω: 2.25 GHz — Agilent 54846A 1 MΩ: 500 MHz (with Agilent 1161A probe)
	System Bandwidth	Agilent 1161A 10:1 passive probe: 500 MHz Agilent 1162A 1:1 passive probe: 25 MHz Agilent 1163A 10:1, 500 Ω passive probe: 1.5 GHz Agilent 1152A 2.5 GHz, 0.6 pF active probe: 1.3 GHz (Agilent 54845A) Agilent 1152A 2.5 GHz, 0.6 pF active probe: 1.0 GHz (Agilent 54835A) Agilent 1153A 200 MHz differential probe: 200 MHz
	Real Time bandwidth*	50Ω: Agilent 54835A — 1 GHz (2-channel mode) Agilent 54835A — 500 MHz (4-channel mode) Agilent 54845A — 1.5 GHz (2-channel mode) Agilent 54845A — 1.0 GHz (4-channel mode) Agilent 54846A — 2.25 GHz (2-channel mode) Agilent 54846A — 1.0 GHz (4-channel mode) 1 MΩ: 500 MHz
Rise Time ¹	50Ω: 350 ps (Agilent 54835A) 50Ω: 233 ps (Agilent 54845A) 50Ω: 156 ps (Agilent 54846A) 1 MΩ: 700 ps	
Sensitivity ²	1 MΩ Coupling: 2 mV/div to 2 V/div 50 Ω Coupling: 2 mV/div to 1 V/div	
Input Impedance*	1 MΩ ± 1% (≅12 pf), or 50 Ω ± 1.5%	
VSWR (50 Ω)	54835A/45A dc to 500 MHz: 1.30 500 MHz to 1 GHz: 1.50 1 GHz to 1.5 GHz: 1.75	54846A dc to 500 MHz: 1.30 500 MHz to 1 GHz: 1.50 1 GHz to 1.5 GHz: 1.75 1.5 GHz to 2.25 GHz: 2.50
Input Coupling	dc, ac (7 Hz, available in 1 MΩ only)	
Maximum Input Voltage	1 MΩ: ± 100 V (dc + ac) [ac<10 kHz], CAT I 50 Ω: 5 V _{rms} , CAT I	
Channel-to-channel Isolation (with channels at equal sensitivity)	54835A/54845A dc to 100 MHz: 40 dB 100 MHz to 1 GHz: 30 dB 1 GHz to 1.5 GHz: 25 dB	54846A dc to 100 MHz: 40 dB 100 MHz to 1 GHz: 30 dB 1 GHz to 2.25 GHz: 24 dB
Offset Range	Vertical Sensitivity	Available Offset
	1 MΩ: 2 mV to 104 mV/div > 104 mV to 2 V/div 50Ω: all	± 4 V ± 40 V ± 12 div
Full-resolution channel scales	10, 20, 50, 100, 200, 500, 1000 mV/div (plus 2000 mV/div in 1 MΩ)	
Dynamic Range	± 8 div from center screen	
dc Gain Accuracy ^{*2}	± 1.00% of full scale at full-resolution channel scale.	
Resolution ²	Real Time	8 bits (0.4% of full scale), 12 bits with sufficient averaging (0.024% of full scale)
	Equivalent Time	8 bits (0.4% of full scale), 12 bits with sufficient averaging (0.024% of full scale)



Offset Accuracy* ²	± (1.00% of channel offset + 1% of full scale) at full-resolution channel scale.	
dc Voltage Measurement Accuracy* ²	Dual Cursor	±[(dc gain accuracy)+(resolution)]
	Single Cursor	±[(dc gain accuracy) +(offset accuracy)+(resolution/2)]
AutoProbe Interface	AutoProbe is an intelligent communication and power link between compatible probes and Infiniium scopes. AutoProbe completely configures the scope for the attached probe. For instance, it identifies the probe type and sets up the proper input impedance, attenuation ratio, probe power and offset range, as needed.	

Horizontal

Main Time Base Range	100 ps/div to 20 s/div	
Horizontal Position Range	pre-trigger	0 to -1 s or one full screen width, whichever is larger.
	post-trigger	0 to 1 s or one full screen width, whichever is larger.
Delayed Sweep Range	1 ps/div to current main time base setting.	
Delayed Sweep Delay Range	Within main time base acquisition record.	
Resolution	2 ps	
Timebase Accuracy	70 ppm (.007%)	
Δt Accuracy*	Real Time mode ⁴	±[(.007%)(Δt)+(0.2)(sample period)]
	Equivalent Time mode	±[(.007%)(Δt)+(full scale/ (2 × memory depth)) + 30 ps] (Example: for ≥ 16 avgs, 9 ns signal, 1 ns/div, 1 channel, then accuracy = ±[(.007%)(9 ns)+(10 ns/(2 × 65,536)) + 30 ps] = 31 ps)



Trigger

Sensitivity* ²	Internal	dc to 100 MHz: 0.5 div 100 MHz to 500 MHz: 1.0 div 500 MHz to 1 GHz: 1.5 div
Maximum Input Voltage*	Auxiliary	dc to 500 MHz: 300 mV _{pp}
	Auxiliary	±15 V, CAT I
Minimum Pulse Width (internal, external)	500 ps at > 1.0 div	
Level Range	Internal	±8 div from center screen
	Auxiliary	±5 V
Sweep Modes	Auto, triggered, single	
Trigger Coupling	dc, ac (7 Hz), low frequency reject (50 kHz), high frequency reject (50 kHz).	
Trigger Holdoff Range	60 ns - 320 ms	
Trigger Modes	Edge, Glitch, Pattern, State, Delay by Time, Delay by Events, Violation (Setup/Hold Time, Pulse Width, Transition), Video, Line.	
Glitch	Select positive or negative polarity, width. Captures glitches as narrow as 500 ps.	
Pattern	Select inputs as High, Low or X (don't care) to create pattern. Trigger when pattern is entered, exited, present > t, present < t, or present over a range of time. Captures patterns as narrow as 500 ps.	
State	Select one channel as clock, specify other inputs as High, Low or X. Logic Type: AND or NAND	
Delay by Time	Time: 30 ns to 160 ms. The trigger is qualified by an edge. After the delay, a rising/falling edge on any one selected input will generate the trigger.	
Delay by Events	Events: 1 to 16,000,000 rising or falling edges. The trigger is qualified by an edge. After the delay, a rising/falling edge on any one selected input will generate the trigger.	
Violation Trigger	Setup/Hold	Modes: Setup, Hold or Setup and Hold. Select Clock, Thresholds, setup and/or hold time.
	Pulse Width	Triggers on pulse width >t, or <t. Captures pulses as narrow as 500 ps.
	Transition	Select Rise Time or Fall Time, present > t or present < t, thresholds.
Accuracy (time) for glitch, pulse width, and time-qualified pattern	1.5 ns - 20 ns: ±(20% setting + 500 ps) 20 ns - 160 ms: ±(3% setting + 2 ns)	
Video Triggering	525 lines/60 Hz (NTSC), 625 lines/50 Hz (PAL), 875 lines/60 Hz. Trigger on Field 1 or Field 2, any line. User defined triggering: User can specify sync pulse level, width and polarity, edge number.	

Display

Display	8.4-inch diagonal color active matrix LCD module incorporating amorphous silicon TFTs.	
Active Display Area	171 mm x 128 mm (21,888 sq. mm)	
Waveform Viewing Area	104 mm x 159 mm (16,536 sq. mm) in Full screen mode (graphical user interface off)	
Display Resolution	640 pixels horizontally x 480 pixels vertically	
Waveform Colors	Select from 100 hues, 0-100% saturation and 0-100% luminosity.	
Dual Intensity Infinite Persistence	Previous sweeps are stored in half bright display and most recent sweep in full bright. This allows easy differentiation of current and historic information.	
Waveform Overlap	When two waveforms overlap, a third color distinguishes the overlap area.	
Full screen mode	On/Off selectable.	
Connect-the-dots	On/Off selectable.	
Persistence	Minimum, Variable (100 ms to 40 s), Infinite. Up to 6 levels of grey scale.	
Graticule	On/Off (Grid or Frame).	
Grid Intensity	0 to 100%	
Display Update Rate (for instruments equipped with AMD-K6-2 400 MHz processor)	Measurement Conditions	Real Time sampling mode, minimum persistence, triggered sweep, no interpolation, markers off, math off, connect the dots off, 1 channel acquisition, 50 ns/div, statistics off.
	512 point record (2 GSa/s)	Waveforms/sec: > 2,100 V _{pp} Measurements/sec: > 130

Measurements

Automatic Parametrics	33 automatic measurements: V _{pp} , V _{min} , V _{max} , V _{avg} , V _{amptd} , V _{base} , V _{top} , V _{rms} , Preshoot, Overshoot, V _{upper} , V _{middle} , V _{lower} , Rise Time, Fall Time, Period, Frequency, Positive Width, Negative Width, Duty Cycle, Delta Time, T _{max} , T _{min} , FFT Frequency, FFT Magnitude, FFT Delta Frequency, FFT Delta Magnitude, Eye Height, Eye Width, Jitter, Crossing %, Q-factor, Duty Cycle Distortion. Over GPIB only: VTime, TVolts.
Threshold Definition	Selectable 10%, 50%, 90% or 20%, 50%, 80% or Custom (% or absolute voltage).
Top-Base Definition	Standard or Custom (in absolute voltage).
Statistics	On/Off selectable. Current measurement, mean, and standard deviation
Measurement Toolbar	16 Drag and Drop automatic measurement icons.
QuickMeas	Activates 4 preselected automatic measurements.
Markers Modes	Manual Markers, Track Waveform Data, Track Measurements.
Waveform Math	4 function waveforms f1-f4. Select from Add, Subtract, Multiply, Divide, Invert, Magnify, Vs, Min, Max, Integral, Differentiate, FFT Magnitude.

FFT

Frequency Range ⁵	Agilent 54835A — 2-channel mode: dc to 2 GHz (Sample rate/2) Agilent 54835A — 4-channel mode: dc to 1 GHz (Sample rate/2) Agilent 54845A — 2-channel mode: dc to 4 GHz (Sample rate/2) Agilent 54845A — 4-channel mode: dc to 2 GHz (Sample rate/2) Agilent 54846A — 2-channel mode: dc to 4 GHz (Sample rate/2) Agilent 54846A — 4-channel mode: dc to 2 GHz (Sample rate/2)
Freq. Accuracy	$(1/2 \text{ frequency resolution}) + (7 \times 10^{-5})(\text{signal frequency})$
Amplitude Display	Power in dBm
Signal-to-noise ratio	70 dB at 32K memory depth. Noise floor varies with memory depth and with averaging.
Window Modes	Hanning, Flattop, Rectangular.

Computer System/ Storage

CPU	AMD-K5™ PR133 Microprocessor (instrument serial numbers US37349999 and below) or AMD-K6™ 200 MHz Microprocessor or AMD-K6/300™ or AMD-K6-2/300™ 300 MHz Microprocessor	
Disk Drive	1.4 GByte, 2.1 GByte, or higher internal hard drive depending upon the vintage. Storage capacity is limited only by disk space. 3.5", 1.44 Mbyte MS-DOS™ compatible high density floppy disk drive or LS-120 MS-DOS 120 MByte floppy disk drive.	Store and recall setups, waveforms, and store screen images to both the hard drive and the floppy drive.
File types	Waveforms	Internal Y values; X and Y values in ASCII or Microsoft Excel formats.
	Images	BMP, EPS, GIF, PCX, PS (Postscript), TIF.
Mouse	Standard mouse supplied—supports any Microsoft® mouse compatible pointing device, serial or PS/2.	
Operating System	Microsoft Windows 95 or Microsoft Windows 98	
Waveform Memories	4 nonvolatile waveform reference memories.	

I/O

LAN	Enables data/setup file transfers and use of network printers; supports popular network operating systems including Novell NetWare, Microsoft, Banyan VINES, SCO UNIX and IBM; 10 Mbps operation that complies with IEEE 802.3 Ethernet and ISO/IEC 8802-3 Ethernet standards; TCP/IP protocol; RJ-45 connector.
GPIB	Fully programmable, complies with IEEE 488.2.
RS-232 (serial)	2 ports: COM1, COM2. Printer and pointing device support.
Centronics	Printer port.
USB	Two pinheads link with Universal Serial Bus connectors (USB1 and USB2) peripheral devices via either a dual-port USB cable or a single-port USB cable on some configurations with serial prefixes US39480000 and above.
Printers and Plotters	Supports all printers and plotters compatible with Microsoft Windows 95®. Includes but is not limited to Hewlett-Packard Deskjet and Laserjet printers. GPIB devices not supported.
PS/2 port	For PS/2 mouse.
Keyboard port	For optional keyboard.

Video Output 15-pin VGA, full color.

Notes

- 1 Rise Time figures are calculated from: $t_r = .35/\text{Bandwidth}$.
- 2 Magnification is used below the 10 mV/div range and between the major attenuation settings. Full scale is defined as the major attenuator setting over an intermediate setting.
(Major settings for 50Ω: 10, 20, 50, 100, 200, 500, 1000 mV
Major settings for 1 MΩ: all as for 50Ω plus 2 V)
- 3 N/A
- 4 For bandwidth limited signals, $t_r \geq 1.4 \times \text{sample interval}$.
- 5 FFT amplitude readings are affected by input amplifier roll-off (-3 dB, with amplitude decreasing as frequency increases above 500 MHz in 1 MΩ, 2.25 GHz for Agilent 54846A, 1.5 GHz in 50Ω for Agilent 54845A, 1 GHz in 50Ω for Agilent 54835A).

CAT I and CAT II Definitions

Installation category (overvoltage category) I: Signal level, special equipment or parts of equipment, telecommunication, electronic, etc., with smaller transient overvoltages than installation category (overvoltage category) II.

Installation category (overvoltage category) II: Local level, appliances, portable equipment etc., with smaller transient overvoltages than installation category (overvoltage category) III.

Agilent Technologies 54835A/45A/46A general characteristics

The Infiniium oscilloscopes meet the Agilent Technologies Environmental Specification (section 750) for class B-1 products with exceptions as described for temperature.

General Characteristics

Environmental	Temperature	Operating: 10°C to +40°C Nonoperating: -40°C to 70°C Indoor use only
	Humidity	Operating: Up to 95% relative humidity (noncondensing) at +40°C Nonoperating: Up to 90% relative humidity at +65°C
	Altitude	Operating: Up to 4 600 meters Nonoperating: Up to 15 300 meters
	Vibration	Operating: Random vibration 5-500 Hz, 10 minutes per axis, 0.3g (rms) Nonoperating: Random vibration 5-500 Hz, 10 minutes per axis, 2.41g (rms) Resonant search 5-500 Hz, swept sine, 1 octave/minute sweep rate, (0.75g), 5-minute resonant dwell at 4 resonances per axis.
Physical	Size (excluding handle)	Height: 216 mm Width: 437 mm Depth: 440 mm
	Weight	Net: approximately 12 kg Shipping: approximately 15 kg
Power	Line voltage selection	None, PFC (Power Factor Correction)
	Line voltage range	100-240VAC, $\pm 10\%$ CAT II
	Line frequency	47 to 440 Hz
	Maximum power consumption	390 W
Safety	Meets IEC1010-1 +A1, CSA certified to C22.2 No. 1010.1, Self certified to UL 3111.	