PicoScope 9231A

12 GHz Sampling Oscilloscope

Performance Test Record

Instrument Model Number:	**9231A**	
Description:	**12 GHz Sampling Oscilloscope**	
Serial Number / Year:	**AV712/xxx**	**2013**
Date & Type of Calibration:	**07 Jan 2015**	
As Found / As Left:	**As Left**	
Test Record Reference:	**AV712/xxx 07/01/2015**	
Ambient Temperature:	**24.0 °C**	**± 1.0 °C**
Ambient Humidity:	**55%**	**± 5%**
Technicians:	**Name 1**	
	Name 2	
This Test Record supports Certificate No:	**XXXXX**	
Certificate issued for end Customer name:	**Customer Name**	

Calibration Standards Employed	Manufacturer	Model No.	Serial No.	Cal due date
Signal Synthesiser	Hittite	HMC-T2240	SN000555	
Power Meter	Agilent	N1914	MY52260009	
Power Sensor	Agilent	N8485	MY52230002	
DMM	Fluke	8845A	SN2329003	
Pattern Generator	Tektronix	PPG1251	SN6146879	
Optical Impulse Source	Calmar Laser	FPL-01CFF	SN881039	

Performance Test Calibration Certificate XXXXX	Test Conditions	Minimum	Actual	Maximum	Performance Results
VERTICAL					
Channel 1: Input Impedance		49.0 Ω	50.3 Ω	51.0 Ω	PASS
Channel 2: Input Impedance		49.0 Ω	49.8 Ω	51.0 Ω	PASS
Channel 1: DC Voltage Accuracy					
Without Digital Feedback (Multi-valued acquisition)	Scale: 5 mV/div Offset: 0 mV Input: 0 mV	-2.8 mV	-0.5 mV	2.9 mV	PASS
	Scale: 100 mV/div Offset: 0 mV Input: 300 mV	282 mV	285 mV	318 mV	PASS
	Scale: 100 mV/div Offset: 0 mV Input: -300 mV	-318 mV	-295 mV	-282 mV	PASS
With Digital Feedback (Single-valued acquisition)	Scale: 5 mV/div Offset: 0 mV Input: 0 mV	-2.8 mV	-1.2 mV	2.9 mV	PASS
	Scale: 100 mV/div Offset: 0 mV Input: 300 mV	282 mV	299 mV	318 mV	PASS
	Scale: 500 mV/div Offset: 0 mV Input: 950 mV	868 mV	957 mV	1032 mV	PASS
	Scale: 100 mV/div Offset: 0 mV Input: -300 mV	-318 mV	-303 mV	-282 mV	PASS
	Scale: 500 mV/div Offset: 0 mV Input: -950 mV	-1032 mV	-950 mV	-868 mV	PASS
Channel 2: DC Voltage Accuracy					
Without Digital Feedback (Multi-valued acquisition)	Scale: 5 mV/div Offset: 0 mV Input: 0 mV	-2.8 mV	0.1 mV	2.9 mV	PASS
	Scale: 100 mV/div Offset: 0 mV Input: 300 mV	282 mV	296 mV	318 mV	PASS
	Scale: 100 mV/div Offset: 0 mV Input: -300 mV	-318 mV	-301 mV	-282 mV	PASS
With Digital Feedback (Single-valued acquisition)	Scale: 5 mV/div Offset: 0 mV Input: 0 mV	-2.8 mV	0.8 mV	2.9 mV	PASS
	Scale: 100 mV/div Offset: 0 mV Input: 300 mV	282 mV	302 mV	318 mV	PASS
	Scale: 500 mV/div Offset: 0 mV Input: 950 mV	868 mV	940 mV	1032 mV	PASS
	Scale: 100 mV/div Offset: 0 mV Input: -300 mV	-318 mV	-300 mV	-282 mV	PASS
	Scale: 500 mV/div Offset: 0 mV Input: -950 mV	-1032 mV	-978 mV	-868 mV	PASS
Channel 1: RMS Noise, Full Bandwidth	Scale: 5 mV/div. Offset: 0 V.	None	1.57 mV	2 mV	PASS
Channel 1: RMS Noise, Narrow Bandwidth	Scale: 5 mV/div. Offset: 0 V.	None	1.01 mV	1.5 mV	PASS

Performance Test Calibration Certificate XXXXX	Test Conditions	Minimum	Actual	Maximum	Performance Results
VERTICAL					
Channel 2: RMS Noise, Narrow Bandwidth	Scale: 5 mV/div. Offset: 0 V.	None	1.39 mV	1.5 mV	PASS
Channel 2: RMS Noise, Full Bandwidth	Scale: 5 mV/div. Offset: 0 V.	None	0.94 mV	2 mV	PASS
Channel 1: Bandwidth					
	Frequency: 100 MHz, Input: 100 µW		1		
	Frequency: 1 GHz, Input: 100 µW	-3 dB	0.94	3 dB	PASS
	Frequency: 2 GHz, Input: 100 µW	-3 dB	0.91	3 dB	PASS
	Frequency: 3 GHz, Input: 100 µW	-3 dB	0.88	3 dB	PASS
	Frequency: 4 GHz, Input: 100 µW	-3 dB	0.94	3 dB	PASS
	Frequency: 5 GHz, Input: 100 µW	-3 dB	0.98	3 dB	PASS
	Frequency: 6 GHz, Input: 100 µW	-3 dB	0.96	3 dB	PASS
	Frequency: 7 GHz, Input: 100 µW	-3 dB	0.94	3 dB	PASS
	Frequency: 8 GHz, Input: 100 µW	-3 dB	0.82	3 dB	PASS
	Frequency: 9 GHz, Input: 100 µW	-3 dB	0.8	3 dB	PASS
	Frequency: 10 GHz, Input: 100 µW	-3 dB	0.73	3 dB	PASS
	Frequency: 11 GHz, Input: 100 µW	-3 dB	0.84	3 dB	PASS
	Frequency: 12 GHz, Input: 100 µW	-3 dB	0.72	3 dB	PASS
Channel 2: Bandwidth					
	Frequency: 100 MHz, Input: 100 µW		1		
	Frequency: 1 GHz, Input: 100 µW	-3 dB	0.92	3 dB	PASS
	Frequency: 2 GHz, Input: 100 µW	-3 dB	0.88	3 dB	PASS
	Frequency: 3 GHz, Input: 100 µW	-3 dB	0.9	3 dB	PASS
	Frequency: 4 GHz, Input: 100 µW	-3 dB	0.93	3 dB	PASS
	Frequency: 5 GHz, Input: 100 µW	-3 dB	0.95	3 dB	PASS
	Frequency: 6 GHz, Input: 100 µW	-3 dB	0.93	3 dB	PASS
	Frequency: 7 GHz, Input: 100 µW	-3 dB	0.89	3 dB	PASS
	Frequency: 8 GHz, Input: 100 µW	-3 dB	0.8	3 dB	PASS
	Frequency: 9 GHz, Input: 100 µW	-3 dB	0.79	3 dB	PASS
	Frequency: 10 GHz, Input: 100 µW	-3 dB	0.71	3 dB	PASS
	Frequency: 11 GHz, Input: 100 µW	-3 dB	0.85	3 dB	PASS
	Frequency: 12 GHz, Input: 100 µW	-3 dB	0.75	3 dB	PASS
Channel 1: Rise Time @ Narrow Bandwidth					
	Rise Time, 10% to 90%	None	40.1 ps	≤ 43.7 ps	PASS
Channel 2: Rise Time @ Narrow Bandwidth					
	Rise Time, 10% to 90%	None	34.2 ps	≤ 43.7 ps	PASS

Performance Test Calibration Certificate XXXXX	Test Conditions	Minimum	Actual	Maximum	Performance Results
HORIZONTAL					
Time base Accuracy	*For >450 ps/div: ±0,2% of of Delta Time Interval ± 15 ps.* *For <=450 ps/div: ± 15 ps or ± 5% of Delta Time Interval ± 5 ps, whichever is smaller.*				
	Sequential Real Time Sampling: From >=10 µs/point to 50 ms/div. ***For >450 ps/div: ±0,2% of of Delta Time Interval ± 15 ps.***				
	Frequency: 5 Hz Scale: 50 ms/div Period	199.6 ms	200.1 ms	200.4 ms	PASS
	Frequency: 50 Hz Scale: 5 ms/div Period	19.96 ms	19.99 ms	20.04 ms	PASS
	Frequency: 500 Hz Scale: 500 us/div Period	1.996 ms	1.999 ms	2.004 ms	PASS
	Combine Equivalent Time Sampling: From >=1 µs/div to <10 us/point. ***For >450 ps/div: ±0,2% of of Delta Time Interval ± 15 ps.***				
	Frequency: 5 kHz Scale: 50 us/div Period	199.6 µs	199.9 µs	200.4 µs	PASS
	Frequency: 50 kHz Scale: 5 us/div Period	19.96 µs	19.99 µs	20.04 µs	PASS
	Sequential Equivalent Time Sampling: From 10 ps/div to <1 us/div. ***For >450 ps/div: ±0,2% of of Delta Time Interval ± 15 ps.***				
	Frequency: 500 kHz Scale: 500 ns/div Period	1.996 µs	2.001 µs	2.004 µs	PASS
	Frequency: 5 MHz Scale: 50 ns/div Period	199.585 ns	200 ns	200.415 ns	PASS
	Frequency: 10 MHz. Scale: 20 ns/div Period	99.785 ns	100 ns	100.215 ns	PASS
	Frequency: 20 MHz Scale: 10 ns/div Period	49.885 ns	49.97 ns	50.115 ns	PASS
	Frequency: 50 MHz Scale: 5 ns/div Period	19.945 ns	19.97 ns	20.055 ns	PASS
	Frequency: 100 MHz Scale: 2 ns/div Period	9.965 ns	10 ns	10.035 ns	PASS
	Frequency: 200 MHz Scale: 1 ns/div Period	4.975 ns	5.002 ns	5.025 ns	PASS
	Frequency: 500 MHz Scale: 500 ps/div Period	1.981 ns	2.014 ns	2.019 ns	PASS
	Frequency: 1 GHz Scale: 200 ps/div Period	0.983 ns	1.014 ns	1.017 ns	PASS
	Frequency: 2 GHz Scale: 100 ps/div Period	484 ps	488.3 ps	516 ps	PASS
	For <=450 ps/div: ± 15 ps or ± 5% of Delta Time Interval ± 5 ps, whichever is smaller. To=200 ps				
	Frequency: 5 GHz Scale: 50 ps/div Period	185 ps	194.2 ps	215 ps	PASS
	Frequency: 8 GHz Scale: 20 ps/div Period	113.8 ps	120.9 ps	139.4 ps	PASS
	Frequency: 8 GHz Scale: 450 ps/div				
	Period Maximum	113.8 ps	130.2 ps	136.2 ps	PASS
	Period Minimum	113.8 ps	122.8 ps	136.2 ps	PASS

Performance Test Calibration Certificate XXXXX	Test Conditions	Minimum	Actual	Maximum	Performance Results
EXTERNAL DIRECT TRIGGER					
External Direct Trigger Bandwidth and Sensitivity	*100 mV p-p DC to 100 MHz.* *Increasing linearly from 100 mV p-p at 100 MHz to 200 mV p-p at 2.5 GHz*				
	Frequency: 100 MHz. Input: 100 mV p-p. Frequency	99 MHz	99.93 MHz	101 MHz	PASS
	Frequency: 1 GHz. Input: 200 mV p-p. Frequency	0.99 GHz	1.003 GHz	1.01 GHz	PASS
RMS External Direct Trigger Jitter	*4.0 ps + 20 ppm of delay setting*				
	Frequency: 1 GHz Input: 600 mV p-p Delay: 0 ns RMS Jitter	None	3.5855 ps	≤ 4 ps	PASS
	Frequency: 1 GHz Input: 600 mV p-p Delay: 100 ns RMS Jitter	None	3.8416 ps	≤ 6 ps	PASS
	Frequency: 1 GHz Input: 600 mV p-p Delay: 1 us RMS Jitter	None	7.377 ps	≤ 24 ps	PASS
External Direct Trigger Nominal Input Impedance	*(50 ± 1) Ohm*				
	Input Impedance	49.0 Ω	49.9 Ω	51.0 Ω	PASS
External Direct Trigger Delay	*<40 ns*				
	Minimum Delay	None	38.2 ns	40 ns	PASS

EXTERNAL PRESCALE TRIGGER					
External Prescaled Trigger Bandwidth and Sensitivity	*200 mV p-p to 2 V p-p from 1 GHz to 7 GHz, 300 mV p-p to 1 V p-p from 7 GHz to 8 GHz.* *400 mV p-p to 1 V p-p from 7 GHz to 10 GHz typ.*				
	Frequency: 1 GHz. Input: 200 mV p-p. Frequency	990 MHz	999.4 MHz	1010 MHz	PASS
	Frequency: 2 GHz. Input: 200 mV p-p. Frequency	1980 MHz	1997 MHz	2020 MHz	PASS
	Frequency: 4 GHz. Input: 200 mV p-p. Frequency	3960 MHz	3998 MHz	4040 MHz	PASS
	Frequency: 7 GHz. Input: 200 mV p-p. Frequency	6930 MHz	7053 MHz	7070 MHz	PASS
	Frequency: 8 GHz. Input: 300 mV p-p. Frequency	7920 MHz	8004 MHz	8080 MHz	PASS
RMS Prescaled Trigger Jitter	*4.0 ps + 20 ppm of delay setting*				
	Frequency: 1 GHz Input: 600 mV p-p, Delay: 0 ns RMS Jitter	None	3.9485 ps	≤ 4 ps	PASS
	Frequency: 2 GHz Input: 600 mV p-p, Delay: 0 ns RMS Jitter	None	3.7171 ps	≤ 4 ps	PASS
	Frequency: 4 GHz Input: 600 mV p-p, Delay: 0 ns RMS Jitter	None	3.6134 ps	≤ 4 ps	PASS
	Frequency: 8 GHz Input: 600 mV p-p, Delay: 0 ns RMS Jitter	None	3.5823 ps	≤ 4 ps	PASS

Performance Test Calibration Certificate XXXXX	Test Conditions	Minimum	Actual	Maximum	Performance Results
EXTERNAL CLOCK RECOVERY TRIGGER (PS9211A/21A/31A only)					
External Clock Recovery Trigger Bandwidth and Sensitivity	*50 mV p-p from 12.3 Mb/s to 1 Gb/s.* *100 mV p-p from >1 Gb/s to 2.7 Gb/s*				
	Data Rate: 800 Mbps. Input: 50 mV p-p. Frequency	792 MHz	794.1 MHz	802 MHz	PASS
	Data Rate: 1 Gbps. Input: 50 mV p-p. Frequency	990 MHz	998 MHz	1010 MHz	PASS
	Data Rate: 1.25 Gbps. Input: 100 mV p-p. Frequency	1.2375 GHz	1.248 GHz	1.2625 GHz	PASS
	Data Rate: 2.5 Gbps. Input: 100 mV p-p. Frequency	2.475 GHz	2.497 GHz	2.525 GHz	PASS
	Data Rate: 2.7 Gbps. Input: 100 mV p-p. Frequency	2.673 GHz	2.705 GHz	2.727 GHz	PASS
RMS External Clock Recovery Trigger Jitter	*1 ps + 1% of Unit Interval*				
	Data Rate: 800 Mbps Input: 300 mV p-p, Delay: 0 ns RMS Jitter	None	6.5669 ps	≤ 13.5 ps	PASS
	Frequency: 1 Gbps Input: 300 mV p-p, Delay: 0 ns RMS Jitter	None	5.8558 ps	≤ 11 ps	PASS
	Frequency: 1.25 Gbps Input: 300 mV p-p, Delay: 0 ns RMS Jitter	None	5.18 ps	≤ 9 ps	PASS
	Frequency: 2.5 Gbps Input: 300 mV p-p, Delay: 0 ns RMS Jitter	None	4.1844 ps	≤ 5 ps	PASS
	Frequency: 2.7 Gbps Input: 300 mV p-p, Delay: 0 ns RMS Jitter	None	4.6488 ps	≤ 4.7 ps	PASS

Performance Test Calibration Certificate XXXXX	Test Conditions	Minimum	Actual	Maximum	Performance Results
TDT/TDR SYSTEM (PS9211A & PS9231A only)					
TDT Step Amplitude	*Output High Level: 0 V to -50 mV @ 50 Ohm external termination.* *Output Low Level: -330 mV to -470 mV @ 50 Ohm external termination*				
	Output 1				
	Output High Level	-50 mV	-5.8 mV	0 mV	PASS
	Output Low Level	-470 mV	-392 mV	-330 mV	PASS
	Output 2				
	Output High Level	-50 mV	-4.7 mV	0 mV	PASS
	Output Low Level	-470 mV	-402 mV	-330 mV	PASS
TDT System Incident Rise Time (20% to 80%)	*100 ps or less @ 50 Ohm external termination,* typical				
	Output 1				
	Fall Time, 20% to 80%	None	84.2 ps	≤ 100 ps	PASS
	Output 2				
	Fall Time, 20% to 80%	None	68.8 ps	≤ 100 ps	PASS
TDT System RMS Jitter	*4 ps maximum*				
	Output 1				
	Polarity: negative Delay: minimum	None	3.46 ps	≤ 4 ps	PASS
	Output 2				
	Polarity: negative Delay: minimum	None	3.92 ps	≤ 4 ps	PASS

OPTICAL CHANNEL (PS9221A & PS9321 only)					
Unfiltered Optical Bandwidth	*DC to 9 GHz*				
	Full BW	7 GHz	10 GHz	None	PASS
	Narrow BW	-	9.08 GHz		
RMS Noise					
	850 nm	None	5.13 µW	6 µW	PASS
	1310 nm		3.74 µW	4 µW	PASS
	1550 nm		3.67 µW	4 µW	PASS

CERTIFICATE OF CALIBRATION

Issued by: Pico Technology Ltd.

of: James House,
Colmworth Business Park,
St. Neots, Cambridgeshire,
PE19 8YP UNITED KINGDOM

Tel: +44 (0) 1480 396 395

Web: www.picotech.com

Certificate Number:

XXXXX

Signature:

Certificate Revision: V 1.00

Signatory: J. Rososkis

This certificate records compliance with specification after adjustment of the instrument

The instrument has been calibrated in accordance with the manufacturer's verification procedure using standards that are traceable to National Standards. The measurements were made in a controlled environment, ambient temperature during the test is recorded below.

The associated Performance Test Record details the calibration results with a further column indicating the instrument performance relative to the stated specification. The column headed 'Performance Results' indicates compliance or otherwise with the stated specification.

The two possible conditions are indicated as follows:

Pass The equipment complies with the stated specification at the measured points.

Fail The equipment does not comply with the stated specification at the measured points.

To the extent defined on the Performance Test Record, this certificate provides traceability of measurement to recognized concensus standards or ratio type measurements through national standards and to the international system of units of measurement (SI), realised and maintained at the National Physical Laboratory or other recognized national standards laboratories.

Unit Under Test Description	12 GHz Sampling Oscilloscope		End User:	Customer Name
Model	9231A		Measured:	07 Jan 15
Serial Number	AV712/xxx, 2013		Result:	PASS
				Invalid Cal Date
Ambient temperature during test:	24.0 °C	± 1.0 °C		
Relative humidity during test:	55%	± 5%	Performance Test Record:	AV712/xxx 07/01/2015