ARB RIDER AWG-7000

7102(D)/7104(D)
7202(D)/7204(D)/7204(D)-S
7172(D)/7174(D)/ 7174(D)-S

Technical Datasheet

2 / 4 CHANNELS – ALL IN ONE: Function Generator, Arb Generator, Pulse Pattern Generator and Digital Pattern Generator.

- **2, 4 Analog Channels**
- **Up to 20 GS/s**
- **14 Bit Vertical Resolution**
- **Up to 10 GHz output frequency**
- **< 50ps Rise/fall time**
- **100 ps minimum pulse width**
- **Single ended output with up to 5 V_{p-p} into 50 Ω with hardware offset of ±2.5V into 50 Ω. Total Output Voltage Window ±5 V (10 V_{p-p}) into 50 Ω**
- **Differential output with up to 2 V_{p-p} into 100 Ω with common mode voltage of ±2 V into 50 Ω**
- **Up to 9 Gpts Waveform Memory per Channel**
- **Up to 32 Digital Channels in synchronous with analog Generation**
- **Multi-Instrument Synchronization: up to 16 analog and 128 digital channels**

Key performance specifications

- ***AWG Mode***
  - 14-bit vertical resolution
  - Up to 20 GS/s Variable Clock
  - Up to 10 GHz output frequency
  - < 50ps Rise/fall time
  - 32bit digital channels
  - Up to 9 Gpts Waveform Memory per Channel
  - Single ended amplitude up to 5 V_{p-p} into 50 Ω with hardware offset of ±2.5 V into 50 Ω
  - Differential amplitude up to 2 V_{p-p} into 100 Ω load with common mode voltage of ±2 V into 50 Ω
- ***AFG Mode***
  - 6.5 GHz Sine Waveforms
  - Up to 20 GS/s fixed, 14-bit vertical resolution
  - Single ended amplitude up to 5 V_{p-p} into 50 Ω with hardware offset of ±2.5 V into 50 Ω
  - Differential amplitude up to 2 V_{p-p} into 100 Ω load with common mode voltage of ±2 V into 50 Ω
  - Improved proprietary DDS based technology
- ***Pulse Pattern Generator (PPG) Mode*** *- Optional*
  - Up to 6.5Gbit/s NRZ, RZ and R1 bit stream generation
  - 2,3 or 4 levels pattern
  - 64 point arbitrary shape per transition
  - Programmable duration for any transition
  - Up to 12 Mbit (2 levels) and 6 Msymbols (3 or 4 levels) pattern memory for channel
  - Single ended amplitude up to 5 V_{p-p} into 50 Ω with hardware offset of ±2.5 V into 50 Ω
  - Differential amplitude up to 2 V_{p-p} into 100 Ω load with common mode voltage of ±2V into 50 Ω

Features & Benefits

- Sample rate can be programmed in from 1 S/s up to 20 GS/s, with 14-bit vertical resolution, ensures exceptional signal integrity
- Arbitrary waveform memory up to 9 Gpts
- Mixed Signal Generation – 2 or 4 Analog channels with up to 32 synchronized Digital Channels[1] for debugging and validating digital design
- Three operation modes – Simple Rider AFG (DDS AFG mode), True Arb (variable clock Arbitrary AWG mode) and PPG (Pulse/Serial Pattern Generator – Optional).
- Digital outputs provide up to 10 Gb/s data rate in programmable CML standard. CML to LVTTL adapter is available
- Advanced sequencer with up to 16384 user defined waveforms provides the possibility of generating complex signal scenarios with the most efficient memory usage
- Windows based platform with 7in touch screen, front panel buttons and knob
- Compact form factor, convenient for bench top and fully fit with 3U – 19” rackmount standard
- LAN, USB-TMC and GPIB interfaces for remote control

[1] Digital output channels are available in the 7204 and 7174 model only

Applications and Area

Optics & Photonics, RF Wireless

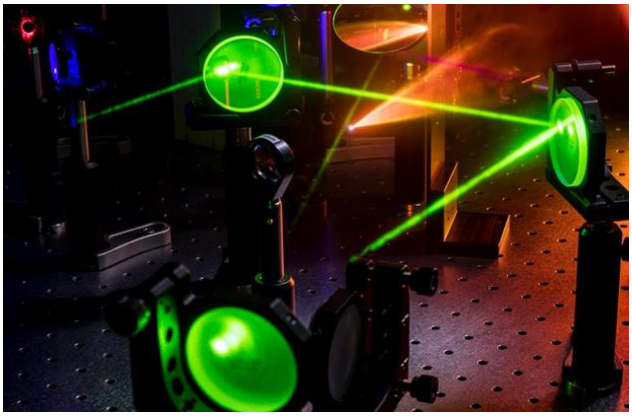


Figure 1: Laser & Photonics

The AWG-7000 is the ideal choice for the frontier of science & technology experiments and cutting-edge challenges like **High Energy Physics**, **Optical**, **laser** and **photonics** and RF Wireless Communication.
The AWG-7000 Series instrument can create virtually any signal - analog or digital, ideal or distorted, standard or custom.

You can easily build complex RF/IF/IQ waveform, extremely small width, high amplitude pulses to drive **electro/acousto-optic modulators**, **pulsed laser diode** or it can be used in quantum optics experiments like manipulating **nitrogen vacancy color center** in diamond.

Highlights

- Drive electro-optic modulator.
- Modulating and driving laser diode.
- Quantum optics emitters testing.
- RF Wireless Digital modulation

Quantum Applications

Figure 2: Quantum Encryption

Emerging Quantum technologies like **Quantum Sensing, Quantum Key Distribution** will improve our lives in the next years.

They will be fundamental tools for secure communications and how we measure,
navigate, study, explore, see, and interact with the world around us by sensing changes in motion, and electric and magnetic fields.

Recently the investigation of light-matter coupling between ensembles of cold atoms and photons propagating in so-called optical nanofibers, i.e.,
glass fibers whose diameter is smaller than the optical wavelength.
The special properties of these fibers make them suitable for use as a "**quantum laboratory**".

The AWG-7000 is the perfect tool to face all these new technological challenges, since it allows you to generate pulses with **ultra-fast rise** and fall time, Gaussian shapes, multi-level PAM and PRBS signals, complex pulse trains, pulsed RF signals with impairments that are the key factors for those kind of tests.

Highlights

- PRBS signals generation.
- QKD and Quantum sensing.
- Cold atoms
- Manipulate nitrogen vacancy color center in diamond.
- Minimum delay between Trigger In Analog Out.
- Up to 16 analog channels and 128 digital channels fully synchronized.
- Built-in sequencer with conditional/unconditional/dynamic jump features, two independent Trigger Inputs, up to 4 Marker outputs.

Automotive

Figure 3: Automotive

Today's cars are including a lot of highly sophisticated electronic control unit with very sensitive electronic components.
As demands go up, next-generation advanced driver-assistance systems (ADAS) require camera and **radar** systems with increasingly high resolution.

Camera, **LIDAR**, Radar and **Ultrasound** devices need higher bandwidth and lower latency networking and complex automotive technologies to come.

Physical layer testing, transmit & receiver testing and channel testing need a high performance and easy-to-use tools to satisfy the latest automotive challenges.
The Arb-Rider 7000 Series combining 20 GS/s with 14-bits vertical resolution, represents the ideal instrument for generating the real-world signals that are necessary to emulate the most demanding testing cases.

Highlights

- Electrical standards emulation up to 5V.
- Physical layer testing.
- Sensor testing.
- EMI debugging, troubleshooting and testing.

Advanced Research Applications

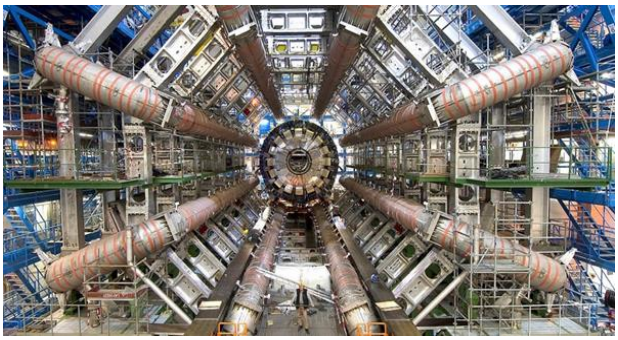


Figure 4:Advanced Research

The AWG-7000 has the best overall product in the market between signal amplitude and bandwidth: you can generate 5Vpp pulses with more than 6.5 GHz of analog bandwidth.

The combination of ultra-fast edge & minimum pulse width generation, excellent dynamic range and easy to use interface perfectly meet the scientists and engineers working on large experiments such **Accelerators**, **Tokamak** or **synchrotrons** to emulate signals without creating specifics test boards.

Pulses may be easily generated for applications such Pulse Electron Beam or X Ray Sources, Flash X-ray Radiography, Lighting pulse simulators, high Power Microwave modulators.

Highlights

- Emulation of detectors.
- Emulation of signal sources adding noise.
- Generation/playback of real-world signals.

Semiconductors Test

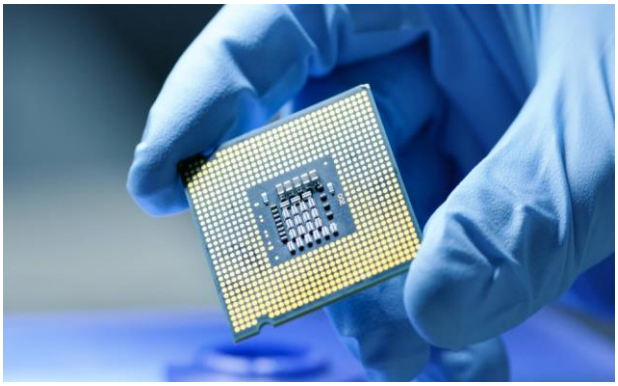


Figure 5: Semiconductors testing

Consumers continually demand better performance in a smaller form factor with reduced power requirements.

This in turn has led to devices with much smaller footprints, much higher data throughput, and lower power requirements. These features enable many of the technologies that consumers take advantage of today such as SATA, USB, and PCI Express.

Aerospace and Defense

Figure 6: Aerospace & Defense applications

Radar, Lidar and Sonar design and testing perfectly

The AWG-7000 Series allows the testing of these

high-speed devices, since it can provide up to 16 analog output channels with a maximum data rate of 8 Gbps and it can perform PCI-Express Gen. 3 debugging.

Emulation of complex signals generated with inclusion of noise or distortions may became an excellent way to provide Compliance Components Test to help semiconductors engineers.

The fast edges and pulse generation can be used to provide characterization in fast power devices.

Highlights

- High-speed serial testing.
- Semiconductors characterization.
- High-speed clock generation.
- Frequency response, intermodulation distortion and noise-figure measurements.
- Pulse Pattern generator.

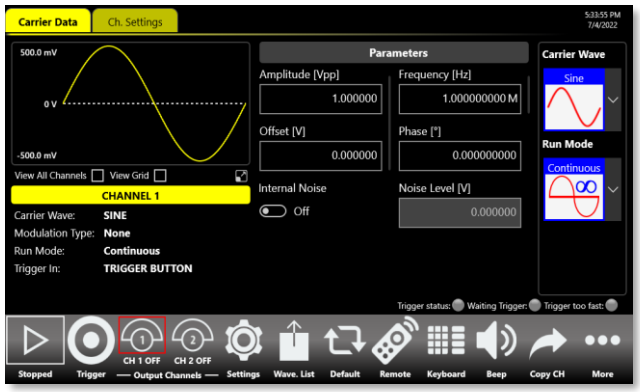
match with the AWG-7000 Series.
Moreover the capability to generate high bandwidth signals can be used on digital modulation systems for Radio Applications or others I/Q signal modulation.
The generation of high-speed signals combined to the advanced sequencer with fast sequence switch feature, allow the emulation of complex real world signal scenarios.

Highlights

- Radar and Lidar RF modulated signals emulation.
- Electronic Warfare complex scenarios generation.
- Avionics testing

Simple Rider AFG: Function Generator Mode Interface

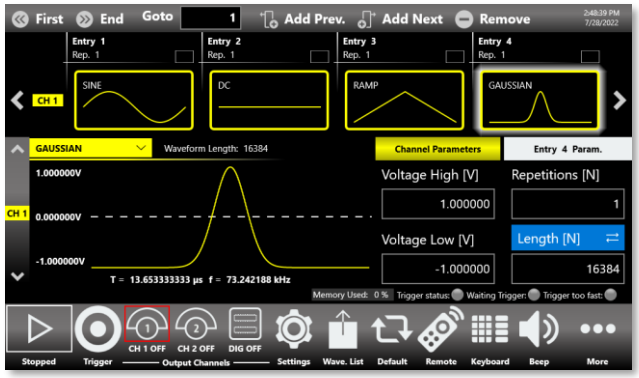
Simple Rider AFG UI is designed for touch and it has been developed to put all the capabilities of modern Waveform Generators right at your fingertips. All instrument controls and parameters are accessed through an intuitive UI that recalls the simplicity of Tablets and modern smart phones: touch features and gestures are available to engineers and scientists to create advanced waveforms or digital patterns in few touches.



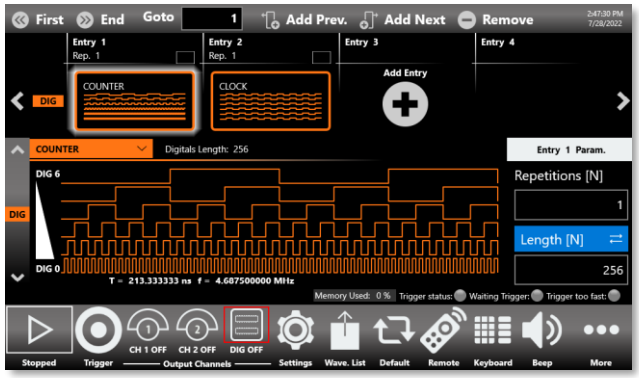
- The swipe gesture gives easy access to the output waveform parameters
- A touch-friendly virtual numeric keypad has been designed to improve the user experience on entering the data.
- Time saving shortcuts and intuitive icons simplify the instrument setup.

Simple Rider TrueArb: AWG Mode Interface

In **Simple Rider True-Arb** interface, the users can define complex waveforms with up to 16,384 sequence entries of analog waveforms and digital patterns, define their execution flow by means of loops, jumps and conditional branches.



Digital output combined and synchronized with analog output signals represent an ideal tool to troubleshoot and validate digital design.
The waveform memory length of up to 9 GSamples on each channel combined with up to 16,384 and up to 4,294,967,294 repetitions, make the Arb-Rider 7202/7204 or the ideal generator for the most demanding technical applications.

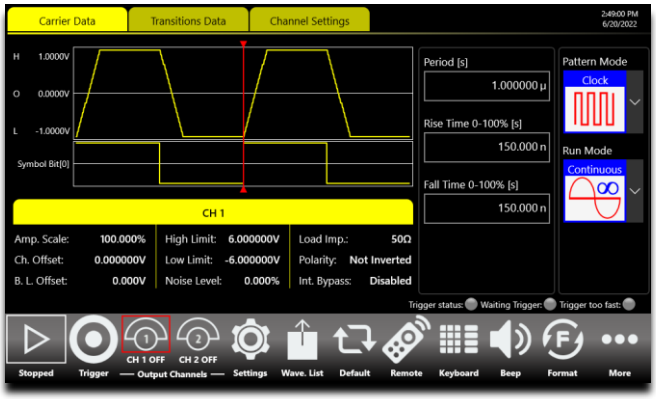


Thanks to the intuitive and easy waveform sequencer user interface, the most complex waveform scenarios can be created with just few screen touches.

Up to 4 instruments can be synchronized together in order to obtain a 16 analog – 128 digital channel generator. A dedicated synchronization bus guarantees the intra-chassis synchronization.Arb Rider supports the standard Ethernet interface for remote control and easy customized instrument programming.

Simple Rider PPG: Pulse Pattern Generator (PPG) Mode Interface

The easiest touch screen display interface allows to create patterns scenarios, only in a few screen touches.
In summary the Pulse Pattern Generator provides the capability to generate PRBS patterns and up to 12 MSymbols custom patterns where bit transitions can have arbitrarily user defined shapes. The ARB-RIDER-AWG7000 Pulse Pattern Generator can generate patterns up to 6.5Gbaud.



The software architecture provides the possibility to easily generate the patterns in different generation modality and also gives the opportunity to modulate the patterns with internal or external signals with the purpose to generate also different effects of noise (jitter, ripple, …).

Table of Available Models

GS/s	Output	Model	Description
20 GS/s	Single ended	**AWG-7202**	2 CH – 5Vpp Single ended outputs – Full memory[2]
		AWG-7204	4 CH – 5Vpp Single ended outputs – Full memory
		AWG-7204-S	4 CH – 5Vpp Single ended outputs – Short memory or 2 CH – 5Vpp Single ended outputs – Full memory
	Differential	**AWG-7202D**	2 CH – 2Vpp (1Vpp single ended) Differential outputs – Full memory
		AWG-7204D	4 CH – 2Vpp (1Vpp single ended) Differential outputs – Full memory
		AWG-7204D-S	4 CH – 2Vpp (1Vpp single ended) Differential outputs – Short memory or 2 CH – 2Vpp (1Vpp single ended) Differential outputs – Full memory
17 GS/s	Single ended	**AWG-7172**	2 CH – 5Vpp Single ended outputs – Full memory
		AWG-7174	4 CH – 5Vpp Single ended outputs – Full memory
		AWG-7174-S	4 CH – 5Vpp Single ended outputs – Short memory or 2 CH – 5Vpp Single ended outputs – Full memory
	Differential	**AWG-7172D**	2 CH – 2Vpp (1Vpp single ended) Differential outputs – Full memory
		AWG-7174D	4 CH – 2Vpp (1Vpp single ended) Differential outputs – Full memory
		AWG-7174D-S	4 CH – 2Vpp (1Vpp single ended) Differential outputs – Short memory or 2 CH – 2Vpp (1Vpp single ended) Differential outputs – Full memory
10 GS/s	Single ended	**AWG-7102**	2 CH – 5Vpp Single ended outputs – Full memory
		AWG-7104	4 CH – 5Vpp Single ended outputs – Full memory
	Differential	**AWG-7102D**	2 CH – 2Vpp (1Vpp single ended) Differential outputs – Full memory
		AWG-7104D	4 CH – 2Vpp (1Vpp single ended) Differential output – Full memory

[2] Full and Short memory modes affect the available waveform memory. For a detailed description see the "Table 1 Waveform memory vs model and operating mode"

Options and Accessories

Item		Description
AWG-7202-PAT	O	Pulse Pattern Generator (PPG) for AWG-7202(D), 7172(D) or 7102(D)
AWG-7204-PAT	O	Pulse Pattern Generator (PPG) for AWG-7204(D), 7174(D) or 7104(D)
AWG-7xx4-8DIG	O	AWG-7xx4-8DIG 8CH Dig license for AWG-7204(D), 7174(D) or 7104(D)
AWG-7xx4-16DIG	O	AWG-7xx4-16DIG 16CH Dig license for AWG-7204(D), 7174(D) or 7104(D)
AWG-7xx4-32DIG	O	AWG-7xx4-32DIG 32CH Dig license for AWG-7204(D), 7174(D) or 7104(D)
AWG-7000-FSS	O	AWG-7000 Fast Sequence Switch
AWG-7xx2-WAR	O	3 years warranty extension for AWG-7202(D), 7172(D) or 7102(D)
AWG-7xx4-WAR	O	3 years warranty extension for AWG-7204(D), 7204(D)-S, 7174(D), 7174(D) -S or 7104(D)
RIDER-MINI-SAS-HD	A	Mini Sas HD cable for digital probe, 8 Differential signal (available only for 4-channels models with long memory)
RIDER-AWG7K-SYNC	A	Synchronization cable for all AWG-7000 models
AT-DTTL8	A	LVDS to LVTTL digital adapter probe (available only for 4-channels models with long memory)
AT-LVDS-SMA8	A	CML to SMA digital adapter cable (available only for 4-channels models with long memory)
GP-IB / USB-TMC	A	GPIB and USBTMC Ports for Remote Control
RIDER-RACK	A	Rackmount kit for Rider instrument system

O = options, A = Accessories

Memory vs model and operating modes

	Channel count	MODEL	Memory per channel (Msamples)							
			FULL RATE mode (20/17Gsps max sampling rate)				HALF RATE mode (10Gsps max sampling rate)			
			CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4
20 GS/s and 17 GS/s	2	AWG-7202 AWG-7202D AWG-7172 AWG-7172D	9600	1.17	-	-	4800	4800	-	-
	4	AWG-7204 AWG-7204D AWG-7174 AWG-7174D	9600	9600	0.589	0.589	4800	4800	4800	4800
10 GS/s	2	AWG-7102 AWG-7102D	-	-	-	-	4800	4800	-	-
	4	AWG-7104 AWG-7104D	-	-	-	-	4800	4800	4800	4800

	Channel count	MODEL	Memory per channel (Msamples)							
			FULL RATE mode (20/17Gsps max sampling rate)				HALF RATE mode (10Gsps max sampling rate)			
			CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4
20 GS/s and 17 GS/s	4	AWG-7204-S AWG-7204D-S AWG-7174-S AWG-7174D-S	**SHORT MEMORY** mode							
			0.512	0.512	0.512	0.512	-	-	-	-
			FULL MEMORY mode							
			9600	1.17	-	-	4800	4800	-	-

Table 1 Waveform memory vs model and operating modes

All specifications are typical unless noted otherwise. The guaranteed performances are referred to a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 5°C to 40°C and after a 45-minute warm up period. Within ±10°C after auto-calibration

General Specifications

	AWG-7202 **AWG-7202D** **AWG-7172** **AWG-7172D** **AWG-7102** **AWG-7102D** 	**AWG-7204** **AWG-7204D** **AWG-7204S[3]** **AWG-7204D-S[3]** **AWG-7174** **AWG-7174D** **AWG-7174-S[3]** **AWG-7174D-S[3]** **AWG-7104** **AWG-7104D** 
Operating Mode	AFG Mode - True Arb Mode - PPG Mode (optional)	
Number of Markers and Analog Channels		
Analog channels	2	4
Markers	2	4

	AWG-7202 **AWG-7202D** **AWG-7172** **AWG-7172D** **AWG-7102** **AWG-7102D** **AWG-7204-S** **AWG-7204D-S** **AWG-7174-S** **AWG-7174D-S** 	**AWG-7204** **AWG-7204D** **AWG-7174** **AWG-7174D** **AWG-7104** **AWG-7104D** 
Number of Digital Channels		
Digital channels	-	32

[3] The AFG Mode has only 2 Channels in -S models.

	AWG-7202 AWG-7204 AWG-7204-S AWG-7172 AWG-7174 AWG-7174-S AWG-7102 AWG-7104 	AWG-7202D AWG-7204D AWG-7204D-SD AWG-7172D AWG-7174D AWG-7174D-S AWG-7102D AWG-7104D 
Output Channels		
Output type	Single ended DC coupled	Differential DC coupled
Output impedance	Single ended: 50 Ω	Single ended: 50 Ω Differential: 100 Ω
Connectors	SMA on front panel	
DC Amplitude		
Amplitude range	±2.5 V (into 50 Ω)	±0.5 V Se. (into 50 Ω) ±1 V Diff. (into 100 Ω)
Resolution	500µV (nom), 5 digits	100µV (nom), 5 digits
Amplitude accuracy	±(1.5% of |setting| + 15mV)[4]	±(1% of |setting| + 2mV)[4]
DC Baseline Hardware Offset (Common mode offset)		
Resolution	< 4 mV or 4 digits	
Range (50 Ω into 50 Ω)	-2.5 V to +2.5 V	-2 V to +2 V
Range (50 Ω into High Z load)	-2.5 V to +2.5 V	-4 V to +4 V
Accuracy (50 Ω into 50 Ω) (guaranteed)	±(1% of |setting| + 15 mV)	±(1% of |setting| + 5 mV)
AC Accuracy (1 kHz sine wave, 0 V offset, > 5 mV_{p-p} amplitude, 50 Ω load) (guaranteed)	± (1% of setting [Vpp] + 5mV)[4]	

[4] The specification is guarantee in the range 0% to 80% of full scale output

True Arb - Baseband mode specifications

	AWG-7202 AWG-7204 AWG-7204-S AWG-7172 AWG-7174 AWG-7174-S AWG-7102 AWG-7104	AWG-7202D AWG-7204D AWG-7204D-S AWG-7172D AWG-7174D AWG-7174D-S AWG-7102D AWG-7104D
General specifications		
Operating Modes	Full Rate Mode (Variable clock) Half Rate Mode (Variable clock)	
Sampling Rate ***AWG-720x(D) / AWG717x(D)*** Model: – Full Rate Mode	1 S/s to 20 GS/s[5] (AWG-720x(D)) 1 S/s to 17 GS/s[5] (AWG-717x(D))	
– Half Rate Mode	1 S/s to 10 GS/s[5]	
AWG-7204(D)-S / AWG7174(D)-S Model:	1 S/s to 20 GS/s[5] (AWG-7204(D)-S) 1 S/s to 17 GS/s[5] (AWG-7174(D)-S)	
AWG-710x(D) Model:	1 S/s to 10 GS/s[5]	
Sin(x)/x	8.85 GHz @ 20GS/S (AWG-7202(D) / AWG7204(D)(-S)) 7.52 GHz @ 17GS/S (AWG-7172(D) / AWG7174(D)(-S)) 4.425 GHz @ 10GS/S (AWG-710x / AWG710xD)	
Run Modes	Continuous, Triggered Continuous, Single/Burst, Stepped, Advanced	
Vertical Resolution	14 bit	

[5] The entire Sample Rate interval is not continuous: [15.726 GHz ÷ 13.764 GHz] / 2^N with N = 0, 1, 2, 3…, 34 are forbidden intervals.

Max Waveform Memory ***AWG-720x(D) / AWG717x(D)*** Models: – Full Rate Mode (20 GS/s)	**AWG7202 / AWG7202D and AWG7172 / AWG7172D**: CH1: 9.6 Gsamples; CH2: 1.17 Msamples **AWG7204 / AWG7204D and AWG7174 / AWG7174D**: CH1, CH2: 9.6 Gsamples; CH3, CH4: 589 ksamples
– Half Rate Mode (10 GS/s)	4.8 Gsamples for channel
AWG-7204(D)-S / AWG7174(D)-S Models: – 4 Channel: Full Rate SHORT MEMORY (20 GS/s)	512 ksamples for every channel
– 2 Channel: Full Rate Mode (20 GS/s) Half Rate Mode (10 GS/s)	CH1: 9.6 Gsamples; CH2: 1.17 Msamples 4.8 Gsamples for channel
AWG-710x(D) Models:	4.8 Gsamples for channel
Waveform Granularity	For **AWG 720x / 720xD** and **AWG 717x / 717xD:** 1 if the entry length is > 8928 samples 288 if entry length is ≥ 288 and ≤ 8928 samples For AWG **7204-S / 7204D-S:** 1 if the entry length is > 512 samples 64 if entry length is ≥ 256 and ≤ 512 samples For AWG **710x / 710xD:** 1 if the entry length is > 4464 samples 288 if entry length is ≥ 288 and ≤ 4464 samples
Sequence Length	1 to 16384
Sequence Repeat Counter	1 to 4294967294 or infinite

Timer		
Range	17.6 ns to 429 ms	
Resolution	± 1 sampling clock cycle	
Analog Channel to Channels skew Range Resolution Accuracy Initial skew	0 to 1.63 us **4CH Model**: Skew Resolution: 1 Sampling Clock Cyle (CHx to CHx (x=1,2,3,4) Skew) FINE Skew Resolution: 100 fs (CH1/CH3 Couple to CH2/CH4 Couple Skew) **2CH Model**: 100 fs ±(1% of setting + 20 ps) < 20 ps	
Calculated bandwidth (0.35 / rise or fall time$_{10\text{-}90}$) – For **20** or **17 GSa/s** model: – For **10 GSa/s** model:	≥ 5 GHz ≥ 2.6 GHz	≥ 5.8 GHz ≥ 3.25 GHz
Measured 3dB bandwidth (sin(x)/x compensated) – For **20** or **17 GSa/s** model: – For **10 GSa/s** model:	5.8 GHz 3 GHz	-
Rise/fall time (1 $V_{p\text{-}p}$ single-ended 20% to 80%) – For **20** or **17 GSa/s** model: – For **10 GSa/s** model: **Rise/fall time (**1 $V_{p\text{-}p}$ single-ended 10% to 90%) – For **20** or **17 GSa/s** model:	 ≤ 50 ps ≤ 85 ps ≤ 70 ps	. ≤ 45 ps ≤ 77 ps ≤ 60 ps

– For **10 GSa/s** model:	≤ 130 ps		≤ 110 ps	
Overshoot (1 V_{p-p} single-ended)	<8%		<6%	
Random jitter on clock pattern (rms, typical)	< 2 ps			
	AWG-7202 AWG-7204 AWG-7204-S AWG-7172 AWG-7174 AWG-7174-S AWG-7102 AWG-7104			
SFDR[6] (2.5 V_{p-p} single-ended, 20 GSa/s)	Measurement Range 1	dBc	Measurement Range 2	dBc
DC – 100 Mhz	DC – 10 Ghz	-70		
DC – 500 Mhz	DC – 10 Ghz	-70		
DC – 2 Ghz	DC – 6 Ghz	-70	DC – 10 Ghz	-60
DC – 3 Ghz	DC – 4 Ghz	-65	DC – 10 Ghz	-55
DC – 4 Ghz	DC – 5 Ghz	-55	DC – 10 Ghz	-52
4 Ghz – 5 Ghz	2 Ghz – 5 Ghz	-65	DC – 10 Ghz	-53
5 Ghz – 6 Ghz	5 Ghz – 10 Ghz	-67	DC – 10 Ghz	-53
6 Ghz – 7 Ghz	4 Ghz – 10 Ghz	-62	DC – 10 Ghz	-46
7 Ghz – 8 Ghz	6 Ghz – 10 Ghz	-62	DC – 10 Ghz	-42
	AWG-7202D AWG-7204D AWG-7204D-S AWG-7172D AWG-7174D AWG-7174D-S AWG-7102D AWG-7104D			
SFDR[6] (0.5 V_{p-p} signle ended, 20 GSa/s)	Measurement Range 1	dBc	Measurement Range	dBc
DC – 100 Mhz	DC – 2 Ghz	-77	DC – 10 Ghz	-67
DC – 500 Mhz	DC – 2 Ghz	-77	DC – 10 Ghz	-67

[6] Channel Optimization = High linearity, Flatness Compensation = Off

DC – 2 Ghz	DC – 6 Ghz	-65	DC – 10 Ghz	-60
DC – 3 Ghz	DC – 4 Ghz	-65	DC – 10 Ghz	-58
DC – 4 Ghz	DC – 6 Ghz	-60	DC – 10 Ghz	-54
4 Ghz – 5 Ghz	2 Ghz – 5 Ghz	-65	DC – 10 Ghz	-53
5 Ghz – 6 Ghz	5 Ghz – 10 Ghz	-70	DC – 10 Ghz	-53
6 Ghz – 7 Ghz	4 Ghz – 10 Ghz	-62	DC – 10 Ghz	-46
7 Ghz – 8 Ghz	6 Ghz – 10 Ghz	-75	DC – 10 Ghz	-42

AFG Mode Specifications

	AWG-7202 AWG-7204 AWG-7204-S AWG-7172 AWG-7174 AWG-7174-S AWG-7102 AWG-7104	AWG-7202D AWG-7204D AWG-7204D-S AWG-7172D AWG-7174D AWG-7174D-S AWG-7102D AWG-7104D
General Specifications		
Amplitude		
Range	0 to 5Vpp (into 50 Ω)	0 to 2Vpp Diff. (into 100 Ω) 0 to 1Vpp Se. (into 50 Ω)
Resolution	500µV (nom), 5 digits	100µV (nom), 5 digits
Operating mode	DDS mode	
Standard Waveforms	Sine, Square, Pulse, Ramp, more (Noise, DC, Sin(x)/x, Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine	
Run Modes	Continuous, modulation, sweep, burst	
Arbitrary Waveforms	Vertical resolution: 14-bit Waveform length: 16,384 points	
Internal Trigger Timer		
Range	10 ns to 100 s	
Resolution	31.25 ps	
Accuracy	±(0.1% setting + 5 ps)	
Sine Waves		
Max Frequency	6.5 GHz (for 20 Gsps and 17 Gsps models) 3.25 GHz (for 10 Gsps models)	
Frequency Range Sine (50 Ω into 50 Ω)	18 mHz to ≤ 3.5 GHz: 5Vpp 3.5 GHz to ≤ 4.5 GHz: 4Vpp	18 mHz to ≤ 6.5 GHz: 2Vpp Diff.

	4.5 GHz to ≤ 6.5 GHz: 3Vpp	18 mHz to ≤ 6.5 GHz: 1Vpp Se.
Flatness	DC to 6 GHz: ±0.5 dB (1 Vpp, relative to 1 kHz)	DC to 6.5 GHz: ±0.5 dB (1 Vpp diff., relative to 1 kHz)
Harmonic Distortion (1 V_{p-p})	18mHz to ≤ 1MHz < -60dBc 1MHz to ≤ 1GHz < -50dBc 1GHz to ≤ 6.5GHz < -40dBc	-
Total Harmonic Distortion (1 V_{p-p})	10 Hz to 20 kHz < 0.2%	-
Phase Noise (1 V_{p-p}, 10 kHz offset)	20 MHz: < -127 dBc/Hz typ. 100 MHz: < -124 dBc/Hz typ. 1 GHz: < -105 dBc/Hz typ.	
Square Waves		
Frequency Range	18 mHz to ≤ 2.5 GHz (for 20 Gsps and 17 Gsps models) 18 mHz to ≤ 1.25 GHz (for 10 Gsps models)	
Rise/fall time (10% to 90%)	120 ps (for 20 Gsps and 17 Gsps models) 240 ps (for 10 Gsps models)	
Rise/fall time (20% to 80%)	90 ps (for 20 Gsps and 17 Gsps models) 180 ps (for 10 Gsps models)	
Overshoot (1 V_{p-p})	<2%	
Jitter (rms)	<2 ps	
Pulse Waves		
Frequency Range	18 mHz to ≤ 2.5 GHz (for 20 Gsps and 17 Gsps models) 18 mHz to ≤ 1.25 GHz (for 10 Gsps models)	
Pulse width	150 ps to (Period – 150 ps)[7] (for 20 Gsps and 17 Gsps models) 300 ps to (Period – 300 ps)[8] (for 10 Gsps models)	

[7] Below 150 ps width ((for 20 Gsps and 17 Gsps models)) or below 300 ps ((for 10 Gsps models)), the pulse amplitude will have some reduction with respect to the set value.

Pulse width Resolution	20 ps or 15 digits	
Pulse duty	0.1% to 99.9% (limitations of pulse width apply)	
Leading/trailing edge transition time (10% to 90%) Leading/trailing edge transition time (20% to 80%)	120 ps to 1000 s (for 20 Gsps and 17 Gsps models) 240 ps to 1000 s (for 10 Gsps models) 90 ps to 1000 s (for 20 Gsps and 17 Gsps models) 180 ps to 1000 s (for 10 Gsps models)	
Transition time Resolution	2 ps or 15 digits	
Overshoot (1 V_{p-p})	< 2%	
Jitter (rms, with rise and fall time ≥ 400ps)	<2 ps	
Double Pulse Waves		
Frequency Range (Vpp= |Vpp1| + |Vpp2|)	for 20 Gsps and 17 Gsps models: 18 mHz to ≤ 1.25 GHz: 10Vpp for 10 Gsps models: 18 mHz to ≤ 625 MHz: 10Vpp	for 20 Gsps and 17 Gsps models: 18 mHz to ≤ 1.25 GHz: 4Vpp Diff. (18 mHz to ≤ 1.25 GHz: 2Vpp Se) for 10 Gsps models: 18 mHz to ≤ 625 MHz: 4Vpp Diff. (18 mHz to ≤ 625 MHz: 2Vpp Se)
Other Pulse Parameters	Same as Pulse Waves	
Ramp Waves		
Frequency Range	18 mHz to 250 MHz (for 20 Gsps and 17 Gsps models) 18 mHz to 125 MHz (for 10 Gsps models)	
Linearity (< 10 kHz, 1 V_{p-p}, 100%)	≤ 0.1%	

Symmetry	0% to 100%	
Other Waves		
Frequency Range		
Exponential Rise, Exponential Decay	18 mHz to 250 MHz (for 20 Gsps and 17 Gsps models) 18 mHz to 125 MHz (for 10 Gsps models)	
Sin(x)/x, Gaussian, Lorentz, Haversine	18 mHz to 500 MHz (for 20 Gsps and 17 Gsps models) 18 mHz to 250 MHz (for 10 Gsps models)	
Additive Noise		
Bandwidth (-3 dB)	4 GHz	
Level	0 V to 2.5 V - abs(carrier max value [V_{pk}])	0 V to 0.5 V Single Ended - abs(carrier max value [V_{pk}]) 0 V to 1 V Differential - abs(carrier max value [V_{pk}])
Resolution	1 mV	
Arbitrary		
Number of Samples	2 to 16384	
Frequency range	1 µHz to 2.5 GHz (for 20 Gsps and 17 Gsps models) 1 µHz to 1.25 GHz (for 10 Gsps models)	
Analog Bandwidth (-3 dB)	2.9 GHz (for 20 Gsps and 17 Gsps models) 1.45 GHz (for 10 Gsps models)	
Rise/fall time (10% to 90%) Rise/fall time (20% to 80%)	120 ps (for 20 Gsps and 17 Gsps models) 240 ps (for 10 Gsps models) 90 (for 20 Gsps and 17 Gsps models) 180 ps (for 10 Gsps models)	
Jitter (rms)	< 2 ps	
Frequency Resolution Sine, square, pulse, arbitrary, Sin(x)/X	18 mHz or 15 digits 18 mHz or 14 digits	

Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine	
Frequency Accuracy	
Non-ARB	± 1.0 ppm of setting
ARB	± 1.0 ppm of setting ±1 μHz
Modulations	
Amplitude Modulation (AM)	
Carrier waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation source	Internal or external
Internal modulating waveforms	Sine, Square, Ramp, Noise, ARB
Modulating frequency	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Depth	0.00% to 120.00%
Frequency Modulation (FM)	
Carrier waveforms	Standard waveforms (except Pulse, Square, DC and Noise), ARB
Modulation source	Internal or external
Internal modulating waveforms	Sine, Square, Ramp, Noise, ARB
Modulating frequency	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Peak deviation	DC to 6.5 GHz (for 20 Gsps and 17 Gsps models) DC to 3.25 GHz (for 10 Gsps models)
Phase Modulation (PM)	
Carrier waveforms	Standard waveforms (except Pulse, Square, DC and Noise), ARB
Modulation source	Internal or external
Internal modulating waveforms	Sine, Square, Ramp, Noise, ARB
Modulating frequency	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Phase deviation range	0° to 360°
Frequency Shift Keying (FSK)	
Carrier waveforms	Standard waveforms (except Pulse, Square, DC and Noise), ARB
Modulation source	Internal or external
Internal modulating waveforms	Square

Key rate	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Hop frequency	1 μHz to 6.5 GHz (for 20 Gsps and 17 Gsps models) 1 μHz to 3.25 GHz (for 10 Gsps models)
Number of keys	2
Phase Shift Keying (PSK)	
Carrier waveforms	Standard waveforms (except Pulse, Square, DC and Noise), ARB
Modulation source	Internal or external
Internal modulating waveforms	Square
Key rate	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Hop phase	0° to +360°
Number of keys	2
Pulse Width Modulation (PWM)	
Carrier waveforms	Pulse
Modulation source	Internal or external
Internal modulating waveforms	Sine, Square, Ramp, Noise, ARB
Modulating frequency	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Deviation range	0% to 50% of pulse period
Sweep	
Type	Linear, Logarithmic, staircase, and user defined
Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Sweep time	4ns ≤ Rise time + Hold time + Fall time ≤ 2000s
Rise/Hold/return times	0 to 2000 s
Rise/hold/return time resolution	1ps or 12 digits
Total sweep time accuracy	≤ 0.4%
Start/stop frequency range	18 mHz to Max Waveform frequency (see Frequency Range for the Specific Waveform)
Trigger source	Internal/External/Manual
Burst	
Waveforms	Standard waveforms (except DC and Noise), ARB
Type	Trigger or gated

Burst count	1 to 4,294,967,295 cycles or Infinite			
	AWG-7202 **AWG-7204** **AWG-7204-S** **AWG-7172** **AWG-7174** **AWG-7174-S** **AWG-7102** **AWG-7104**			
SFDR[6] (2.5 V_{p-p} single-ended, 20 GSa/s)	Measurement Range 1	dBc	Measurement Range 2	dBc
DC – 100 Mhz	DC – 10 Ghz	-70		
DC – 500 Mhz	DC – 10 Ghz	-70		
DC – 2 Ghz	DC – 6 Ghz	-65	DC – 10 Ghz	-60
DC – 3 Ghz	DC – 4 Ghz	-65	DC – 10 Ghz	-55
DC – 4 Ghz	DC – 5 Ghz	-55	DC – 10 Ghz	-52
4 Ghz – 5 Ghz	2 Ghz – 5 Ghz	-65	DC – 10 Ghz	-53
5 Ghz – 6 Ghz	5 Ghz – 10 Ghz	-67	DC – 10 Ghz	-53

Pulse Pattern Generator (PPG) Specifications – *Optional*

	AWG-7202 **AWG-7202D** **AWG-7172** **AWG-7172D** **AWG-7102** **AWG-7102D** **AWG-7204S** **AWG-7204D-S** **AWG-7174-S** **AWG-7174D-S**	**AWG-7204** **AWG-7204D** **AWG-7174** **AWG-7174D** **AWG-7104** **AWG-7104D**
Number of PPG Analog Channels		
PPG Analog channels	2	4
Mark	2	4
	AWG-7202 **AWG-7204** **AWG-7204-S** **AWG-7172** **AWG-7174** **AWG-7174-S** **AWG-7102** **AWG-7104**	**AWG-7202D** **AWG-7204D** **AWG-7204D-S** **AWG-7172D** **AWG-7174D** **AWG-7174S-S** **AWG-7102D** **AWG-7104D**
General Specifications		
Operating mode	NRZ, RZ or R1 bitstream Pattern generator	
Pattern types	Clock Pattern, Custom Pattern, PRBS pattern, Go-Through Pattern, Pulse Pattern	
Run Modes	Continuous, modulation, burst (Triggered, Gated, Continuous triggered)	
Internal Trigger Timer		
Range	10 ns to 100 s	
Resolution	31.25 ps	
Accuracy	±(0.1% setting + 5 ps)	

Transition Specifications	
Tansition peculiarity	Arbitrarily user defined transition shapes Programmable duration for any transition
Transitions types	Arbitrary, predefined
Transitions memory length	64 points
Predefined transition Shapes	Sine, Square, Pulse, Ramp_up, Ramp_down, DC, Sin(x)/x, Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine
Transition duration [0-100%]	For 20 Gsps and 17 Gsps models: 150ps to Symbol duration for Custom, PRBS and Go-Through pattern 150ps to Period/2 for Clock Pattern 150ps to (Period-150ps) for Pulse Pattern For 10 Gsps models: 300ps to Symbol duration for Custom, PRBS and Go-Through pattern 300ps to Period/2 for Clock Pattern 300ps to (Period-300ps) for Pulse Pattern
Clock Pattern	
Max clock pattern frequency	3.25 GHz (for 20 Gsps and 17 Gsps models) 1.625 GHz (for 10 Gsps models)
Pattern levels	2 levels
Overshoot (1 V_{p-p})	< 2 %
Jitter (rms)	< 2 ps
Custom Pattern	
Max custom pattern rate	Up to 6.5 Gbaud (for 20 Gsps and 17 Gsps models) Up to 3.25 Gbaud (for 10 Gsps models)
Pattern levels	2, 3 or 4 levels

Predefined custom patterns	Zero, one, clock, counter
Pattern memory channel	Up to 12 MBit (2 levels) Up to 6 MSymbols (3 or 4 levels) (For 2 channel and -S models) Up to 6 MBit (2 levels) Up to 3 MSymbols (3 or 4 levels) (For 4 channel models)
Pattern length resolution	1 bit
Min pattern length	16 bits
Overshoot (1 V_{p-p})	< 2%
PRBS Pattern	
Max PRBS pattern rate	Up to 6.5 Gbaud (for 20 Gsps and 17 Gsps models) Up to 3.25 Gbaud (for 10 Gsps models)
Pattern levels	2 levels
PRBS types	PRBS -7,9,11,15,23,31
Overshoot (1 V_{p-p})	< 2%
Go-Through Pattern	
Max Go-Through pattern rate	Up to 6.5 Gbaud (for 20 Gsps and 17 Gsps models) Up to 3.25 Gbaud (for 10 Gsps models)
Pattern levels	2,3 or 4 levels
Max External Pattern Rate	Up to 125 Mbit/s
Overshoot (1 V_{p-p})	< 2%
Pulse Pattern	
Max Pulse pattern frequency	Up to 3.25 GHz (for 20 Gsps and 17 Gsps models) Up to 1.625 GHz (for 10 Gsps models)
Pattern levels	

Min Rise/Fall time (0-100%)	2 Levels
Min Pulse Width	150 ps
Overshoot (1 V_{p-p})	300 ps
	< 2%
Pattern Modulation	
Amplitude Modulation (AM)	
Carrier patterns	All types
Modulation source	Internal or external
Internal modulating waveforms	Sine, Square, Triangular, Ramp_up, Ramp_down, DC, Sin(x)/x, Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine, Noise, ARB
Modulating frequency	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Depth	0.00% to 120.00%
Frequency Modulation (FM)	
Carrier patterns	All types
Modulation source	Internal or external
Internal modulating waveforms	Sine, Square, Triangular, Ramp_up, Ramp_down, DC, Sin(x)/x, Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine, Noise, ARB
Modulating frequency	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Peak deviation	DC to 6.5 GSymbols/s (for 20 Gsps and 17 Gsps models) DC to 3.25 GSymbols/s (for 10 Gsps models)
Phase Modulation (PM)	
Carrier patterns	All types
Modulation source	Internal or external

Internal modulating waveforms	Sine, Square, Pulse, Ramp_up, Ramp_down, DC, Sin(x)/x, Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine, Noise, ARB
Modulating frequency	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Phase deviation range	0° to 360°
Frequency Shift Keying (FSK)	
Carrier patterns	All types
Modulation source	Internal or external
Internal modulating waveforms	Square
Key rate	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Hop Symbol Rate	1uSymbols/s to 6.5 GSymbols/s for Custom and PRBS pattern 18 mHz to 3.25 GHz for Clock pattern (for 20 Gsps and 17 Gsps models) 1uSymbols/s to 3.25 GSymbols/s for Custom and PRBS pattern 1uHz to 1.625 GHz for Clock pattern (for 10 Gsps models)
Number of keys	2
Phase Shift Keying (PSK)	
Carrier patterns	All types
Modulation source	Internal or external
Internal modulating waveforms	Square
Key rate	Internal: 18 mHz to 80 MHz, External: 1 GHz max.
Hop phase	0° to +360°
Number of keys	2
Burst	
Patterns	All types

Type	Block mode, Symbols mode
Burst count	1 to 4,294,967,295 cycles or Infinite

Timing and Clock	
Sampling Rate	
Range[5]	
– **For 20 or 17 GSa/s models:**	**Full Rate mode:** 1 S/s to **20** GS/s for 20GSa/s models 1 S/s to **17** GS/s for 17GSa/s models **Half Rate mode:** 1 S/s to **10** GS/s
– **For 10 GSa/s models:**	1 S/s to **10** GS/s
Resolution	64 Hz
Accuracy	± 1.0 ppm
Digital outputs **(Optional for AWG7204(D) / AWG7174(D) / AWG7104(D) models only)**	
Output Channels	
Connectors	Mini-SAS HD connector on rear panel (custom pin-out)
Number of connectors	4

Number of outputs	32-bits
Output impedance	100 Ω differential
Output type	CML with programmable pk-pk amplitude
Maximum update rate	10 Gbps per channel
Memory depth	4.5 Gbit per digital channel
8 bit CML to LVTTL Converter Probe (Optional AT-DTLL8)	
Output connector	20 position 2.54 mm 2 Row IDC Header
Output type	LVTTL
Output impedance	50 Ω nominal
Output voltage	0.8V to 3.8V programmable in group of 8 bits
Maximum Update Rate	125 Mbps@0.8V and 400 Mbps@3.6V
Dimensions	W 52 mm – H 22 mm – D 76 mm
Input Connector	Proprietary standard
Cable Length	1 meter
Cable Type	Proprietary standard
Proprietary Mini SAS HD to SMA cable (Optional) (TBD)	
Output connector	SMA
Output type	CML
Number of SMA	16 (8 differential bits)

Cable type	Proprietary standard
Cable Length	1 meter
Rise/fall time (10% to 90%)	< 300 ps
Jitter (rms)	< 5ps

Auxiliary input and output characteristics	
Sync in/out	
Connector type	QSFP connector on rear panel (custom pinout)
Master to Slave delay (typical)	-
Modulation Input (MOD_IN)	
Connector type	SMA on front panel
Number of connectors	2 (for 2 channel models) 4 (for 4 channel models)
Input impedance	50 Ω
Voltage Window	± 0.5 V
Marker Output	
Connector type	SMA on front panel
Number of connectors	2 (for 2 channel models) 4 (for 4 channel models)
Output impedance	50 Ω
Output level (into 50 Ω)	
Voltage Window	-0.5V to 1.65V
Amplitude	100 mVpp to 2.15 Vpp
Resolution	1 mV
Accuracy	±(5% setting + 25 mV)

Switching characteristics	
Max Update Rate (True Arb Mode)	20 Gbps
Max Data Rate (True Arb Mode)	>4 Gbps @ 1Vpp swing
Max Frequency (AFG Mode)	125 MHz (continuous mode)
Rise/fall time (10% to 90%, 2 Vpp)	<150 ps
Jitter (rms)	<10 ps
Marker out to analog channel skew	
Range	True Arb Mode: 0 to 1.368 µs AFG Mode: 0 to 8.5 sec. in Contin. Mode, 0 to 1.8 µs in Trig. Mode
Resolution	**True Arb Mode**: 1/64 of DAC sampling period (for 20 Gsps and 17 Gsps models) 1/128 of DAC sampling period (for 10 Gsps models) **AFG Mode**: 1.5625 ps
Accuracy	±(1% of setting + 50 ps)
Initial skew	< 20 ps
Marker Width	
Value/Range	**True Arb Mode**: (Marker Automatic Mode) **36** sampling clock cycles (Full Rate Mode) **18** sampling clock cycles (Half Rate Mode) **AFG Mode** (Continuous Mode): 50% of waveform period (Automatic Marker Width Mode), 500ps to waveform period – 2,1ns (Manual Marker Width Mode) AFG Mode (Burst/Sweep Mode): Burst Duration or half of sweep duration

Trigger/Event Inputs	
Connector	SMA on the Front Panel
Number of Trigger Inputs	2 (for 2 channel models) 4 (for 4 channel models)
Input impedance	50Ω / 1kΩ
Slope/Polarity	Positive or negative or both
Range	± 3.5 V (50 Ohm input impedance) ± 10 V (1K Ohm input impedance)
Threshold control level	-8 V to 8 V
Threshold control Resolution	10 mV
Threshold control accuracy	± 100 mV
Minimum pulse width (1 V_{p-p})	1 ns
Trigger/gate input to Analog Output delay	**Slow (synchronous) trigger** AFG mode: < 355 ns (< 380 ns in triggered sweep mode) True Arb mode: <4392 * DAC clock period(ns) + 17.6 ns **Fast (asynchronous) trigger** AFG mode: < 345 ns (< 370 ns in triggered sweep mode) True Arb mode: <4392 * DAC clock period(ns) + 17.6 ns
Trigger In to output jitter (rms)	AFG mode: < 20 ps True Arb mode: 0.29*DAC clock period
Trigger In programmable delay range	0ps to 2418 ps
Trigger In programmable delay resolution	78ps
Maximum Frequency	AFG: 75 MTps on Rising/Falling Edge, 100 MTps on Both Edges True Arb mode: 1/ (Period of the Analog Waveform + 293 DAC Clock period) MTps = Mega Transitions per second

Reference clock input	
Connector type	SMA on rear panel
Input impedance	50 Ω, AC coupled
Input voltage range	0.2Vpp to 3.3Vpp
Damage level	Maximum Input voltage: 3.6Vpp Maximum input power: 15 dBm (50 Ω)
Frequency range	5 MHz to 500 MHz
Frequency Resolution	1 Hz
Reference clock output	
Connector type	SMA on rear panel
Output impedance	50 Ω, AC coupled
Frequency	10 MHz TCXO
Initial accuracy @ 25 °C	± 1.0 ppm
Aging	± 1.0 ppm/year
Stability vs. temperature	± 1.0 ppm
Amplitude	1.65 Vpp
Phase Noise @ 10 MHz carrier	-120 dBc/Hz at 100 Hz ; -140 dBc/Hz at 1KHz;-150 dBc/Hz at 10 KHz
External Clock Input	
Connector type	SMA on rear panel
Input impedance	50 Ω, AC coupled
Frequency[8]	True Arb: SampleRate / N where: N = 8, 16, 32, 64 for every SampleRate [8 - 9]

[8]When using the External Clock Input the SampleRate must be in the range 0÷20 GHz, but the entire Sample Rate interval is not continuous (see the corresponding section in the User manual)
[9] For AWG-717x(D) and AWG-7174(D)-S models the max Sampling rate is limited to 17Gsps

	AFG: 312.5 MHz, 625 MHz, 1250 MHz or 2500 MHz (selectable)
Input Power Range	
Damage Level	+0 dBm to +10 dBm 15 dBm
Sync Clk Out	
Connector type	SMA on rear panel
Output impedance	50 Ω, AC coupled
Frequency	AFG Mode: 20Ghz / N where N=40, 80, 160, …, 5120 AWG Mode: Sampling Rate/N, N=64, 128,.., 8192[9]
Amplitude	1Vpp into 50 Ohm
External Modulation input (AFG only)	
Connector type	SMA on front panel (MOD.IN)
Input impedance	50 Ω
Number of inputs	2 (for 2 channel models) 4 (for 4 channel models)
Bandwidth	1 GHz
Input voltage range	1 Vpp (0,5V to 0.5V)
Vertical resolution	14-bit
Pattern Jump In (optional)	
Connector type	DSUB15
Input signals	DATA[0..7] + Data_Select + Load
Internal Data Width	14 bit, multiplexed using Data_Select
Number of addressable entries	16384
Data Rate	DC to 1 MHz
Input Range	VIL = 0V to 0.8V / VIH= 2V to 3.3V
Impedance	Internal 1kΩ pull-up resistor to Vcc (3.3V)

Power	
Source Voltage and Frequency	100 to 240 VAC ±10% @ 45-66 Hz
Max. power consumption	Max. 300W
Environmental characteristics	
Temperature (operating)	+5 °C to +40 °C (+41 °F to 104 °F)
Temperature (non-operating)	-20 °C to +60 °C (-4 °F to 140 °F)
Humidity (operating)	5% to 80% relative humidity with a maximum wet bulb temperature of 29°C at or below +40°C, (upper limit de–rates to 20.6% relative humidity at +40°C). Non-condensing.
Humidity (non-operating)	5% to 95% relative humidity with a maximum wet bulb temperature of 40°C at or below +60°C, upper limit de–rates to 29.8% relative humidity at +60°C. Non-condensing.
Altitude (operating)	3,000 meters (9,842 feet) maximum at or below 25°C
Altitude (non-operating)	12,000 meters (39,370 feet) maximum
EMC and safety	CE compliant
Safety	EN61010-1
Main Standards	EN 61326-1:2013 – Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements
Immunity	EN 61326-1:2013

System specifications	
Display	7 inch, 1024x600, capacitive touch LCD
Operative System	Windows 10
External Dimensions	W 445 mm – H 135 mm – D 320 mm (3U 19” rackmount)
Weight	Max. 26.45 lbs (12 Kg)
Front panel connectors	CH N OUTPUT (SMA) where N=2,4 depending on the model MOD N INPUT (SMA) where N=2,4 depending on the model MARKER N OUT (SMA) where N=2,4 depending on the model TRG IN N(SMA) where N=2,4 depending on the model 2 USB 3.0 ports
Rear panel connectors	Ref. Clk. IN (SMA) Ref. Clk. Out (SMA) Sync Clk Out (SMA) Ext Clk IN(SMA) Sync IN (QSFP cable) Sync OUT (QSFP cable) Pattern Jump In (DSUB15) (AWG-7000-FSS opt. only) POD X[7..0] where X=A,B,C,D (Customized Mini SAS HD) External Monitor ports (one or more) 2 USB 2.0 ports or more 4 USB 3.0 ports Ethernet port (10/100/1000BaseT Ethernet, RJ45 port) 2 PS/2 keyboard and mouse ports 2 DPI ports 1 DVI port
Hard Disk	1 TB SSD or better
Processor	Intel® Pentium Gold G6400 4 GHz (or better)
Processor Memory	32 GB or better