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SPECIFICATIONS

AT-AWG-GS - 2 Channels Model - Performance Specifications

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Definitions
Specification (spec.)
The warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 0 °C to 55 °C and after a 45-minute warm up period. Within ± 10 °C after autocal. Data published in this document are specifications (spec) only where specifically indicated.
Typical (typ.)
The characteristic performance, which 80% or more of manufactured instruments will meet. This data is not warranted, does not include measurement uncertainty, and is valid only at room temperature (approximately 23 °C).

Specifications				
Number of Analog Channels	2			
Number of Digital Channels	32			
Resolution	14 Bit			
Sampling Rate	7.4 MS/s to 2.5 GS/s			
Channel operating Mode	Arbitrary / DDS			
Device operating Mode	16/32 Ch. Digital and 2 Ch Analog			
DC-coupled analog output				
Characteristics	**Amplified output**		**Direct DAC output**	
Output type	Single ended or differential			
Impedance	50 Ω / 100 Ω			
Amplitude, 50 Ω Load (1KHz) Full Scale Range, Single Ended Full Scale Range, Differential Resolution AC Accuracy, Single Ended, Open	 2Vp-p 4Vp-p <1mV ± (0.4% of single-ended Vrms output range + 5 mVrms)		 0.8Vp-p 1.6Vp-p <1mV ± (0.6% of single-ended Vrms output range + 5 mVrms)	
Vocm (Output common mode voltage) Range Resolution, 50Ω load Accuracy, Open	 -0.8V to 0.8V@50Ω load <10mV ± (2.5% of Vocm output range + 5 mV)		 -0.35V to 0.35V@50Ω load <10mV ± (2.5% of Vocm output range + 5 mV)	
Rise/fall time (10% to 90%)	550 ps (without filter), typ. 650 ps (with internal filter), typ (Pulse at 1 Vp-p S.E.)		330 ps, typ. (Pulse at 0.5 Vp-p S.E.)	
Calculated bandwidth ($0.35/T_{10\text{-}90}$)	650 MHz (1Vp-p without filter), typical 550 MHz (1Vp-p with filter), typical		1 GHz (at 0.5Vp-p), typical	
Overshoot	<4 % (at 1Vp-p)		< 3 % (at 0.5Vp-p)	
RMS Random Jitter on clock pattern, typ	<6 ps		<4 ps	
Total Jitter on	<150 ps at 2.5GS/s 600Mbit/s PN15 pattern, measured at BER= 1e-12		<120 ps at 2.5GS/s 600Mbit/s PN15 pattern, measured at BER= 1e-12	
Phase noise (dBc/Hz) (internal clock, 2.5 GS/s), typical	*1 KHz (offset)*	*10 KHz(offset)*	*100 KHz(offset)*	*1 MHz(offset)*
10 MHz	-132	-134	-151	-154
100 MHz	-113	-114	-133	-149
156 MHz	-109	-108	-128	-146
312 MHz	-103	-102	-123	-142

625 MHz (Direct DAC Output)	-94	-97	-116	-136

Spectral Analysis – ARB Mode	**DIRECT DAC Output**			
Harmonic Distortion Sine Wave 32 points (78.125 MHz), typical	S.E. -65 dBc, 1Vp-p	Diff. -65 dBc, 2Vp-p	S.E. -72 dBc, 0.5Vp-p	Diff. -72 dBc, 1Vp-p
Non Harmonic Distortion Sine Wave 32 points (78.125 MHz), typical	-74 dBc, 1Vp-p, DC to 600 MHz		-74 dBc, 0.5Vp-p, DC to 1 GHz	
SFDR (including Harmonics) @ 2.5GS/s (ARB Mode), typical	S.E. (DC to 600MHz, 1Vp-p)	Diff. (DC to 600MHz, 2Vp-p)	S.E. (DC to 1GHz, 0.5Vp-p)	Diff. (DC to 1GHz, 1Vp-p)
Sine Wave 32 points (78.125 MHz)	-65 dBc	-65 dBc	-71 dBc	-72 dBc
Sine Wave 16 points(156.25 MHz)	-55 dBc	-60 dBc	-66 dBc	-65 dBc
Sine Wave 8 points (312.5 MHz)	-40dBc	-51 dBc	-54 dBc	-60 dBc

Spectral Analysis – DDS Mode	**Amplified Output with filter**
Harmonic Distortion, typ. DDS Amplified Output 50Ω into 50Ω with Filter	S.E. (DC to 600 MHz), 1Vp-p 1 µHz to 2 MHz, -74 dBc 2 MHz to 10 MHz, -74 dBc 10 MHz to 50 MHz, -74 dBc 50 MHz to 200 MHz, -49 dBc 200 MHz to 500 MHz, -33 dBc 500 MHz to 580 MHz, -33 dBc 580 MHz to 600 MHz, -35 dBc
Non Harmonic (spurious) Distortion, typ. DDS Amplified Output 50Ω into 50Ω with Filter	S.E. (DC to 600 MHz), 1Vp-p 1 µHz to 1 MHz, -67 dBc 1 MHz to 10 MHz, -70 dBc 10 MHz to 280 MHz, -53 dBc 280 MHz to 300 MHz, -58 dBc 330 MHz to 500 MHz, -50 dBc 500 MHz to 580 MHz, -35 dBc 580 MHz to 600 MHz, -30 dBc

AC-coupled analog output				
Output type	Single-ended			
Impedance	50 Ω			
Amplitude, 50 Ω Load (1KHz) Full Scale Range, Single Ended Resolution	2Vp-p (+10 dBm) <1 mV			
Calculated bandwidth (0.35/T_{10-90})	1.1 GHz, typical (300 ps @ 1Vpp)			
Harmonic distortion, typ.				
Sine Wave 32 points (78.125 MHz)	-68 dBc, -2dBm (0.5Vp-p)	-68 dBc, +4dBm (1Vp-p)	-56 dBc, +8dBm (1.5Vp-p)	
Sine Wave 16 points (156.25 MHz)	-65 dBc -2dBm (0.5Vp-p)	-59 dBc +4dBm (1Vp-p)	-52 dBc +8dBm (1.5Vp-p)	
Sine Wave 8 points (312.5 MHz)	-60 dBc -2dBm (0.5Vp-p)	-55dBc +4dBm (1Vp-p)	-46dBc +8dBm (1.5Vp-p)	
Non harmonic distortion, typ.	-78 dBc, DC to 1 GHz			
Phase noise (dBc/Hz) (internal clock, 2.5 GS/s), typical	1 KHz (offset)	10 KHz (offset)	100 KHz (offset)	1 MHz (offset)
10 MHz	-132	-134	-151	-154
100 MHz	-113	-114	-133	-149
156 MHz	-109	-108	-128	-146
312 MHz	-103	-102	-123	-142
625 MHz	-94	-97	-116	-136
Arbitrary Mode				
Arbitrary Mode Specifications				
Waveform Length	64 to 64M samples in multiple of 64 for < 320 samples or in multiple of 16 for >= 320 samples			
Waveform Granularity	1 point			
Number of Waveforms	1 to 16384			
Sequence Length	1 to 16384			
Sequence Repeat Counter	1 to 2097151 or infinite			
Sequence Control	Repeat Waveform, Wait for Multiple Triggers (up to 7 triggers), Wait for Multiple Events (up to 7 events), Jump if Event (up to 7 events, sync. or asynch), Jump to (sync. or asynch)			
Subsequence Control	Repeat Waveform, Wait for Multiple Triggers (up to 7 triggers), Wait for Multiple Events (up to 7 events), Jump if Event (up to 7 events, sync. or asynch), Jump to (sync. or asynch)			
Run Modes				
Continuous	Waveform is iteratively output. If a sequence is defined, the sequence order and repeat functions are applied			
Triggered	Waveform is output only once when an internal, external, programmatic or manual trigger is received			
Gated	Waveform begins output when gate is "True" and resets when gate is "False"			
Sequence	Waveform is output as defined by the sequence selected			
Sampling Clock				
Resolution	8 digits			
Internal Clock				
Stability	< ± 0.5 ppm			
Aging	< ± 1 ppm / year			
Max. Real Sample Rate	2.5 GS/s			

DDS Mode	
Amplitude Flatness (with compensation) DDS Amplified Output 50Ω into 50Ω with Filter	±0.3 dB 1Vp-p, DC to 600MHz
Output Frequency Resolution	0.6Hz
Frequency Modulation	
Carrier Waveforms	Sine,square,ramp,arbitrary
Internal Modulation	Sine,square,ramp,noise,arbitrary
Modulation update rate	2.32Hz to 312.5MHz
Frequency range	0.6Hz to 600 MHz
Phase Modulation	
Carrier Waveforms	Sine,square,ramp,arbitrary
Internal Modulation	Sine,square,ramp,noise,arbitrary
Modulation update rate	2.32Hz to 312.5MHz
Phase range	0 to 360º
Phase resolution	8.4E-8 degree
Amplitude Modulation	
Carrier Waveforms	Sine,square,ramp,arbitrary
Internal Modulation	Sine,square,ramp,noise,arbitrary
Modulation update rate	2.32Hz to 312.5MHz
Modulation depth	-200% to 200%
Modulation depth resolution	0.025%
Channel Bandwidth	600 MHz
Modulation Source	Internal
DDS Mode Modulation Sequencer	
Modulating Waveform	
Length	8 to 8M samples in multiple of 8
Granularity	1 point
Number of Waveforms	1 to 16384
Sequence	
Length	1 to 16384
Repeat Counter	1 to 2097151 or infinite
Sequence Control	Repeat Modulation Law Waveform, Wait for Multiple Triggers (up to 7 triggers), Wait for Multiple Events (up to 7 events), Jump if Event (up to 7 events, sync. or asynch), Jump to (sync. or asynch)
Subsequence Control	Repeat Modulation Law Waveform, Wait for Multiple Triggers (up to 7 triggers), Wait for Multiple Events (up to 7 events), Jump if Event (up to 7 events, sync. or asynch), Jump to (sync. or asynch)
Run Modes	
Continuous	Modulation Law Waveform is iteratively output. If a sequence is defined, the sequence order and repeat functions are applied
Triggered	Modulation Law Waveform is output only once when an internal, external, programmatic or manual trigger is received
Gated	Modulation Law Waveform begins output when gate is "True" and resets when gate is "False"
Sequence	Modulation Law Waveform is output as defined by the sequence selected

CH1, CH2	Amplified Output	Direct DAC Output	AC Output
Output connector	SMA		
Output impedance	50Ω S.E. / 100Ω Diff.	50Ω S.E. / 100Ω Diff.	50Ω
Io max, typ	±65mA	±150 mA	-
External Clock IN			
Input connector	SMA		
Input Voltage Range	-10 dBm to 8 dBm		
Impedance	50 Ω, AC Coupled		

Frequency range	1.25 GHz to 2.5 GHz
Damage Level	+11 dBm MAX ±25VDC MAX
Reference Clock IN	
Input connector	SMA
Input Voltage Range	-10 dBm to 10 dBm
Impedance	50 Ω, AC Coupled
Frequency range	10 MHz to 105 MHz
Damage Level	+16 dBm MAX ±25VDC MAX
External Trigger Input	
Input connector	SMA
Max. Switching Rate	70 MHz
Input impedance	1.1 KΩ
Trigger Level Control Range Resolution	 -15V to 15V 50 mV
Damage level	VINmax < 25 V VINmin > -25V
Slope	Rising Edge or Falling
Pulse width, minimum	8 ns
Trigger IN to output jitter	±0.5 sampling periods
Trigger IN to output delay	TBD
Trigger Hold-off[1]	TBD
Smart Trigger[2]	TBD
External Trigger Output	
Output connector	SMA
Trigger Level Control Range Resolution	 2V to 5.5V < 5 mV
Output impedance	50 Ohm nominal
Digital Output	
Connector	INFINIBAND 12x connector
Connector count	2
Multi Channel Specifications	
Skew Control between analog channels (all channels at the same sampling rate)	
Range[3]	10 ps ÷ 204400 ps (@2.5GS/s)
Resolution, typ	10 ps
Multi Instrument Synchronization	
Max Number of Instruments	≥ 2
Synchronization resolution	10 ps

[3] The range depends on the sampling rate

Digital Data Output	
Number of Channels	32
Output standard	LVDS
Connector	Infiniband 12x
Skew Control between digital channels (all channels at the same sampling rate)	
Range[4]	78 ps ÷ 51399 ps(@2.5GS/s)
Resolution	78 ps
Vector Memory Depth	32M points / Ch.
Max. Update Rate ARB Mode	1.25 GS/s (16 Ch.), 625 MS/s (32 Ch.)
Max. Update Rate DDS Mode	312.5 MS/s (32 Ch.)

[4] The range depends on the sampling rate