

# SDG2000X Series

Function/Arbitrary  
Waveform Generator



DataSheet-2016.12



# SDG2122X

# SDG2082X

# SDG2042X

## Overview

SIGLENT's SDG2000X is a series of dual-channel function/arbitrary waveform generators with specifications of up to 120MHz maximum bandwidth, 1.2GSa/s sampling rate and 16-bit vertical resolution. The proprietary TrueArb & EasyPulse techniques help to solve the weaknesses inherent in traditional DDS generators when generating arbitrary, square and pulse waveforms. With advantages above, SDG2000X can provide users with a variety of high fidelity and low jitter signals, which can meet the growing requirements of complex and extensive applications.

## Key Features

- ▶ Dual-channel, 120MHz maximum bandwidth, 20Vpp maximum output amplitude, high fidelity output with 80dB dynamic range
- ▶ High-performance sampling system with 1.2GSa/s sampling rate and 16-bit vertical resolution. No detail in your waveforms will be lost
- ▶ Innovative TrueArb technology, based on a point-by-point architecture, supports any 8pts~8Mpts Arb waveform with a sampling rate in range of 1 $\mu$ Sa/s~75MSa/s
- ▶ Innovative EasyPulse technology, capable of generating lower jitter Square or Pulse waveforms, brings a wide range and extremely high precision in pulse width and rise/fall times adjustment
- ▶ Plenty of analog and digital modulation types: AM、DSB-AM、FM、PM、FSK、ASK、PSK and PWM
- ▶ Sweep and Burst function
- ▶ Harmonic function
- ▶ 196 built-in arbitrary waveforms
- ▶ High precision Frequency Counter
- ▶ Standard interfaces: USB Host, USB Device ( USBTMC ) , LAN ( VXI-11 )
- ▶ Optional interface: GPIB
- ▶ 4.3" touch screen display for easier operation



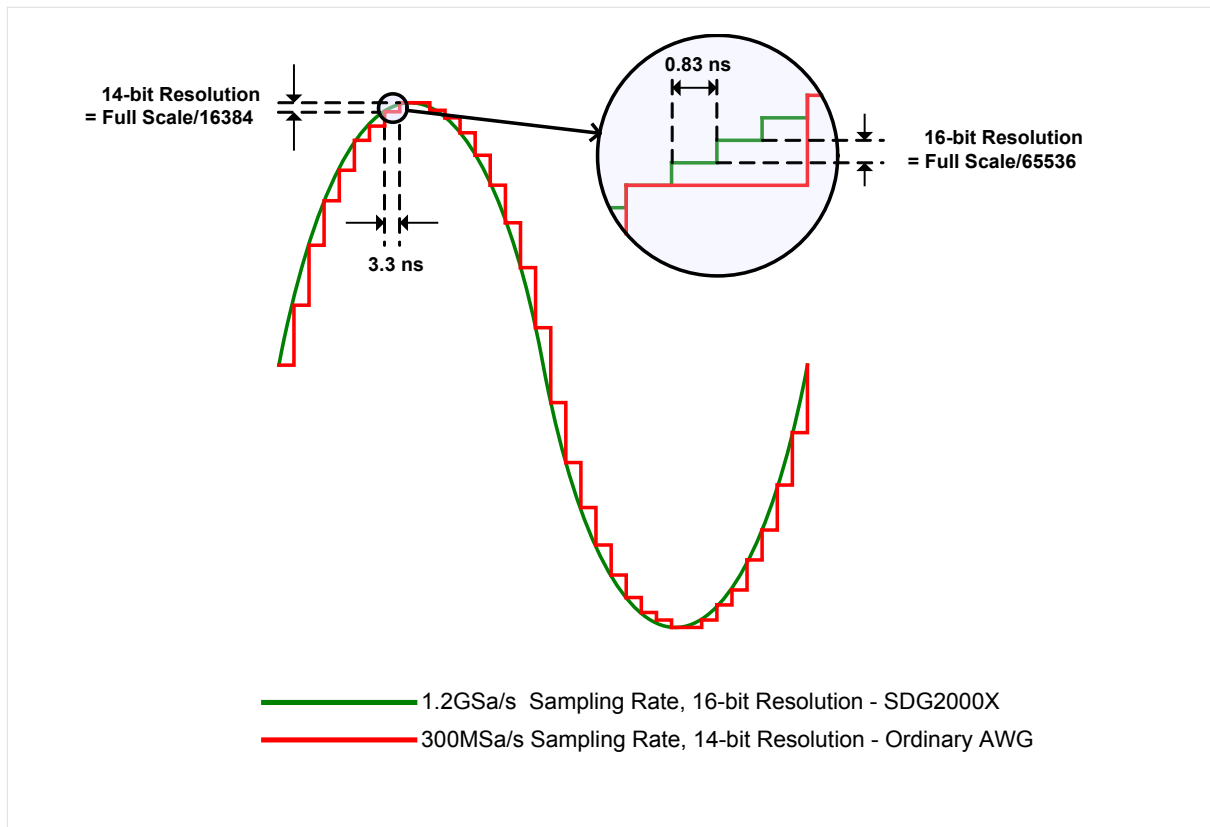
## Models and Key Specifications

Product Model	SDG2042X	SDG2082X	SDG2122X
Bandwidth	40MHz	80 MHz	120 MHz
Sampling rate	1.2 GSa/s (4X Interpolation)		
Vertical resolution	16 bit		
Num. of channels	2		
Max. amplitude	±10V		
Display	4.3" touch screen display, 480 x 272 x RGB		
Interface	Standard: USB Host, USB Device, LAN Optional: GPIB (USB-GPIB adaptor)		

## Characteristics

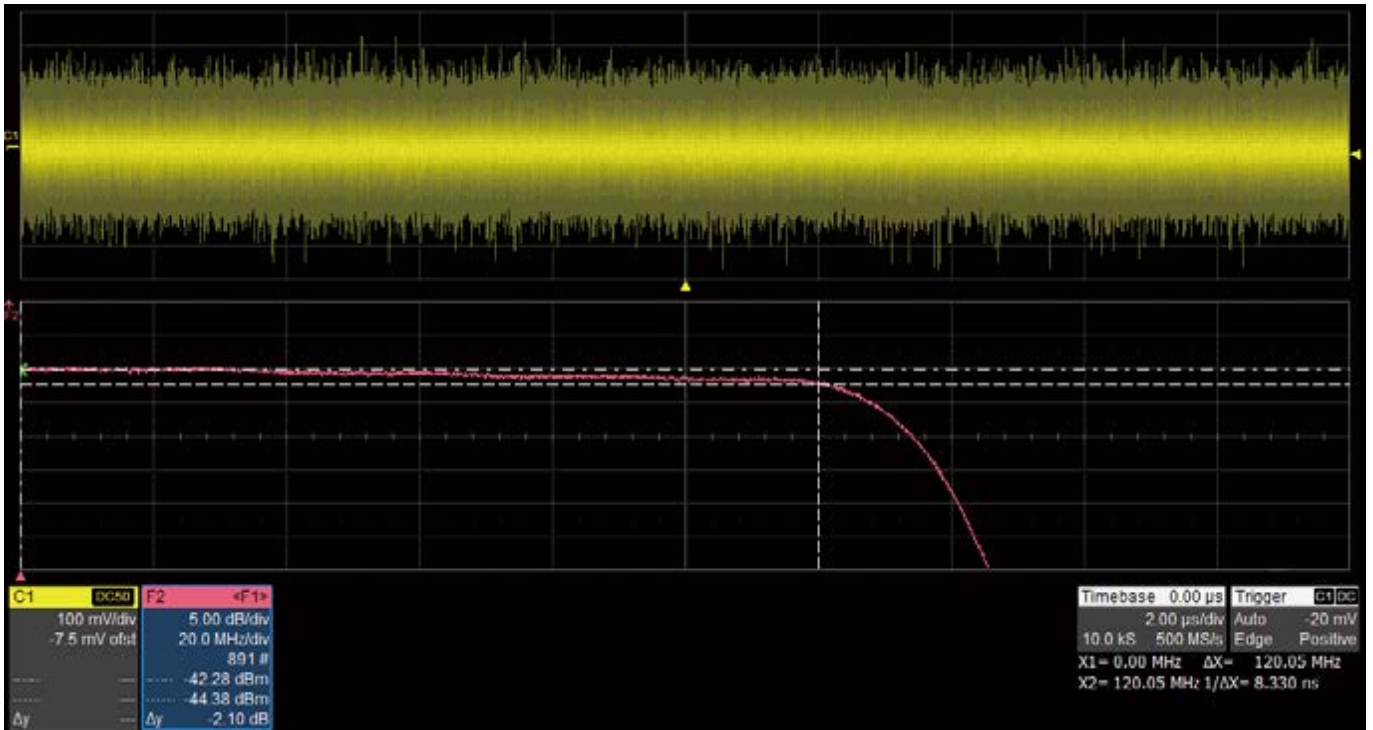
### High-performance Sampling System

Benefiting from a 1.2GSa/s and 16-bit sampling system, SDG2000X achieves extremely high accuracy performance in both time domain and amplitude, which results in more accurately reconstructed waveforms and lower distortion.

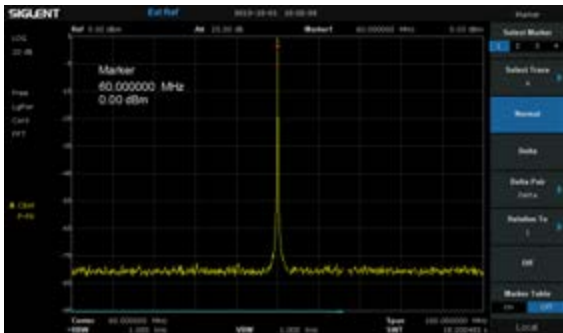


# Characteristics

## Excellent Analog Channel Performance

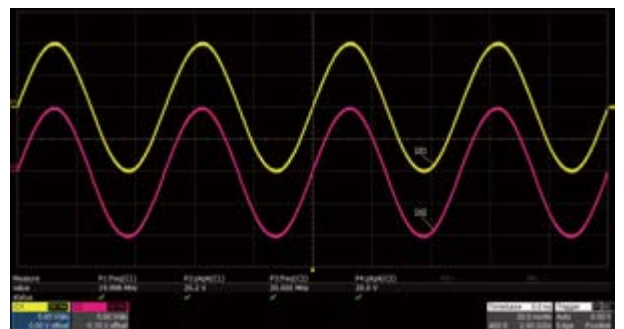


▲ The bandwidth of analog channels proves to be greater than 120MHz, via doing a frequency response test with white noise.

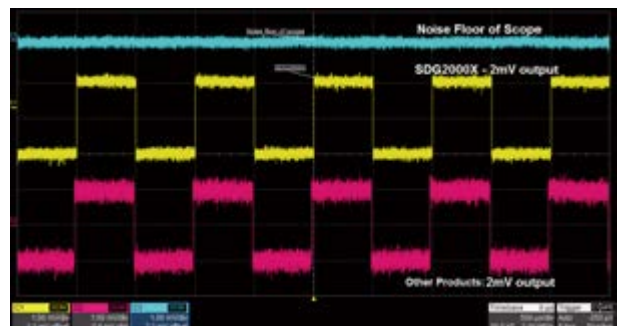


◀ High fidelity sine output. Almost no spurious observed @60MHz, 0dBm.

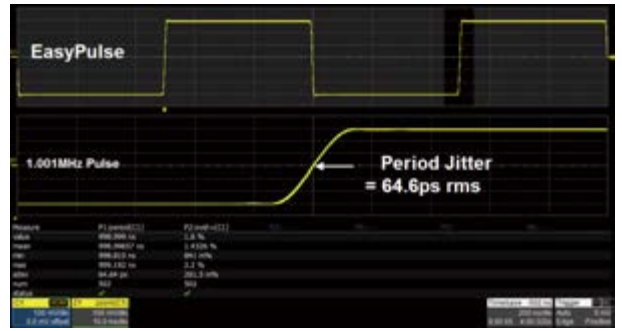
▶ Capacity of outputting large signal at high frequency. Dual-channel, 20 Vpp amplitude can be guaranteed even @20 MHz.



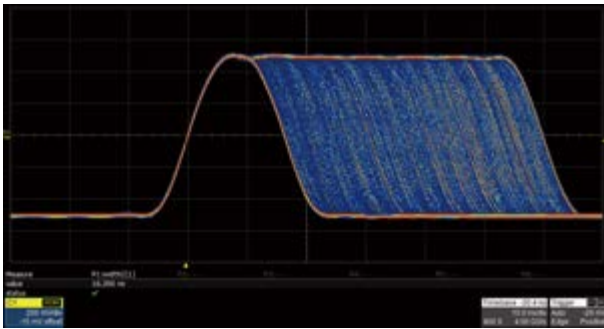
▶ Low noise floor, improves signal-noise ratio.



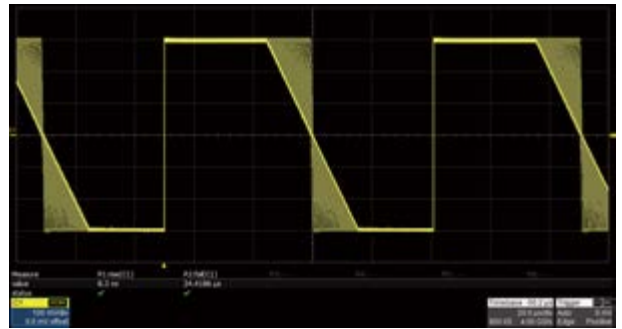
## Innovative EasyPulse Technology



When a Square/Pulse waveform is generated by DDS, there will be a one-clock-jitter if the sampling rate is not an integer-related multiple of the output frequency. SDG2000X EasyPulse technology successfully overcomes this weakness in DDS designs and helps to produce low jitter Square/Pulse waveforms.



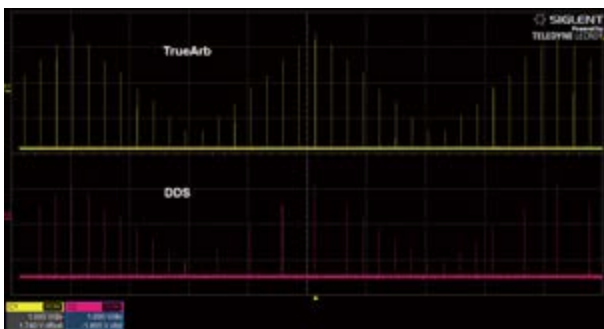
The Pulse width can be fine-tuned to the minimum of 16.3ns with the adjustment step as small as 100ps.



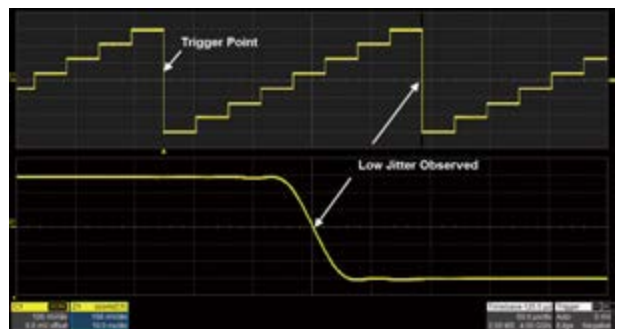
The rise/fall times can be set independently to the minimum of 8.4ns at any frequency and to the maximum of 22.4s. The adjustment step is as small as 100 ps.

## Innovative TrueArb Technology

For arbitrary waveforms, TrueArb not only has all the advantages of traditional DDS, but also eliminates the probability that DDS may cause serious jitter and distortion.



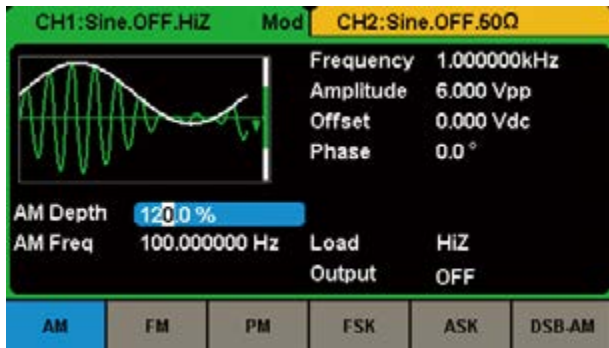
TrueArb generates arbitrary waveforms point by point, never skips any point so that it can reconstruct all the details of the waveform as defined.



As with EasyPulse, TrueArb effectively overcomes the defect that DDS may cause the one-clock-jitter in arbitrary waveforms.

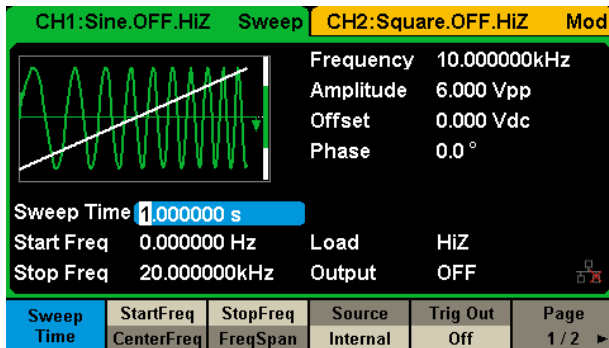
## Characteristics

### Modulation



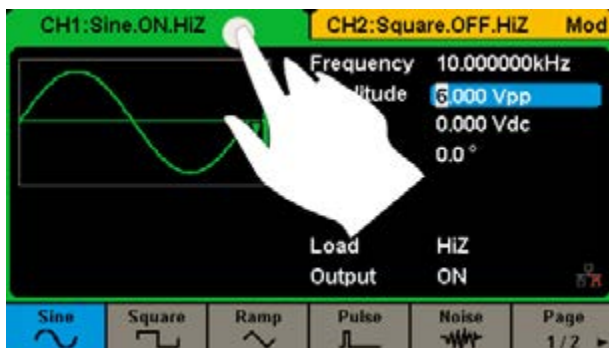
SDG2000X supports plenty of modulation types, such as AM, FM, PM, FSK, ASK, PSK, DSB-AM, and so on. The modulation source can be configured as "Internal" or "External".

### Sweep



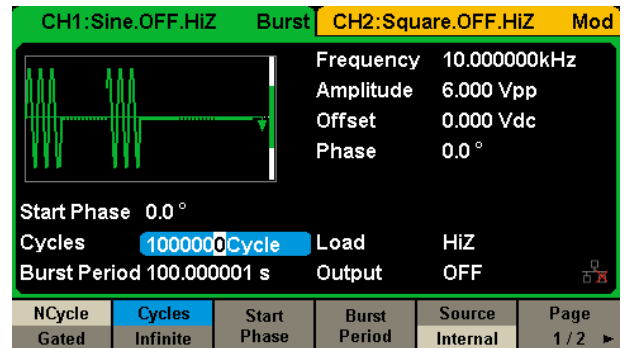
SDG2000X supports two Sweep modes, "Linear" and "Log". Two Sweep directions, "Up" and "Down" and three Sweep sources, "Internal", "External" and "Manual".

### 4.3" Touch Screen Display



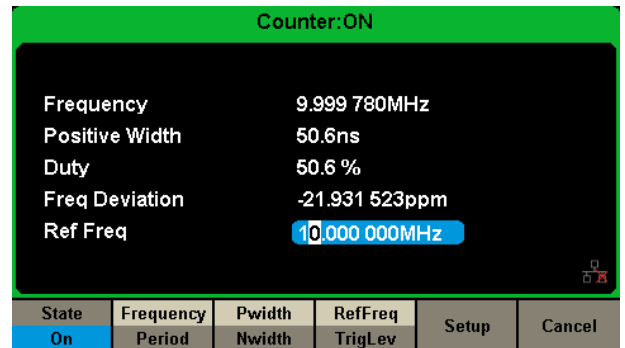
4.3" touch screen display, makes operation much more convenient.

### Burst



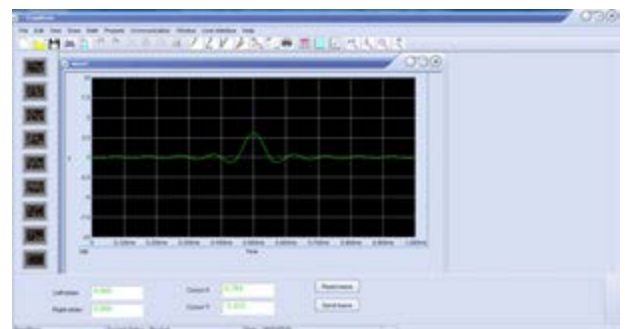
SDG2000X supports two Burst modes, "N cycle" and "Gated". The Burst source can be configured as "Internal", "External" or "Manual".

### Frequency Counter



High precision Frequency Counter with an input frequency range of 0.1Hz~200MHz.

### Arbitrary Waveform Software EasyWave



EasyWave is a powerful arbitrary waveform editing software that supports several ways to generate arbitrary waveform such as manual drawing, line-drawing, equation-drawing, coordinate-drawing, etc. It is quite convenient for users to edit their own arbitrary waveforms through EasyWave.

## Specifications

All specifications apply to both channels. Unless otherwise stated, all specifications are not guaranteed unless the following conditions are met:

- The generator is within calibration period of validity
- The generator has been working continuously for at least 30 minutes at a specified temperature (18°C ~ 28°C ).

### Frequency Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Resolution			1μ	Hz	
Initial accuracy	-1		+1	ppm	25°C
	-2		+2	ppm	0~40°C
1 <sup>st</sup> -year aging	-1		+1	ppm	25°C
10-year aging	-3.5		+3.5	ppm	25°C

### Sine Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	1μ		120M	Hz	SDG2122X
	1μ		80M	Hz	SDG2082X
	1μ		40M	Hz	SDG2042X
Harmonic distortion			-65	dBc	0 dBm, 0~10 MHz (Included)
			-60	dBc	0 dBm, 10~20 MHz (Included)
			-55	dBc	0 dBm, 20~40 MHz (Included)
			-50	dBc	0 dBm, 40~60 MHz (Included)
			-45	dBc	0 dBm, 60~80 MHz (Included)
			-40	dBc	0 dBm, 80~100 MHz (Included)
			-38	dBc	0 dBm, 100~120 MHz (Included)
Total Harmonic Distortion			0.075	%	0 dBm, 10 Hz ~ 20 kHz
Non-harmonic spurious			-70	dBc	≤50 MHz
			-65	dBc	>50 MHz

### Square Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	1μ		25M	Hz	
Rise/fall times			9	ns	10% ~ 90%, 1 Vpp, 50ΩLoad
Overshoot			3	%	100 kHz, 1 Vpp, 50ΩLoad
Duty cycle	0.001		99.999	%	Limited by frequency setting
Jitter (rms), Cycle to cycle			150	ps	1 Vpp, 50Ω Load

### Pulse Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	1μ		25M	Hz	
Pulse width	16.3			ns	
Pulse width accuracy			±(0.01%+0.3ns)		
Rise/fall times	8.4n		22.4	s	10% ~ 90%, 1 Vpp, 50Ω Load, Subject to pulse width limits
Overshoot			3	%	100 kHz, 1 Vpp
Duty cycle	0.001		99.999	%	Limited by frequency setting
Duty cycle resolution	0.001			%	
Jitter (rms) cycle to cycle			150	ps	1 Vpp, 50Ω Load

### Noise Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
-3dB bandwidth	120			MHz	
Adjustable bandwidth range	20		120	MHz	

## Specifications

### Ramp Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	1 $\mu$		1M	Hz	
Symmetry	0		100	%	
Linearity			1	%	Percentage of peak-peak output, 1kHz, 1Vpp, 100% symmetry

### Arbitrary Wave characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	1 $\mu$		20M	Hz	
Waveform length	8		8M	pts	
Sampling rate	1 $\mu$		75M	Sa/s	TrueArb mode
	300			MSa/s	DDS mode
Vertical resolution	16			bit	
jitter (rms)			150	ps	1 Vpp, 50 $\Omega$ Load, TrueArb mode

### DC Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Range	-10		10	V	HiZ load
	-5		5	V	50 $\Omega$ load
Accuracy	$\pm(1\%+2mV)$				HiZ load

### Harmonic Output Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Order			10		
Type	Even, Odd, All				

### Output Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Range (Note 1)	2m		20	Vpp	$\leq 20$ MHz, HiZ load
	2m		10	Vpp	$> 20$ MHz, HiZ load
Accuracy	$\pm(1\%+1mVpp)$				10 kHz sine, 0 V offset
Amplitude flatness	-0.3		+0.3	dB	0~100 MHz (Included), 50 $\Omega$ load, 2.5Vpp, compare to 10kHz Sine
	-0.4		+0.4	dB	100~120 MHz (Included), 50 $\Omega$ load, 2.5Vpp, compare to 10kHz Sine
Output impedance	49.5	50	50.5	$\Omega$	10kHz sine
Output current	-200		200	mA	
Crosstalk			-60	dBc	CH1 - CH2/CH2 - CH1

Note 1: The specification will be divided by 2 while applied to a 50 $\Omega$  load.

### Modulation Characteristics

#### AM

Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation Source	Internal/External				
Modulating wave	Sine, Square, Ramp, Noise, Arb				
Modulation depth	0		120	%	
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"

#### FM

Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation Source	Internal/External				
Modulating wave	Sine, Square, Ramp, Noise, Arb				
Frequency deviation	0		0.5*BW		BW is the max. output frequency Limited by frequency setting
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"



## Specifications

### Modulation Characteristics

PM					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation Source	Internal/External				
Modulating wave	Sine, Square, Ramp, Noise, Arb				
Phase deviation	0		360	°	
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"
ASK					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation Source	Internal/External				
Modulating wave	Square with 50% duty cycle				
Keying frequency	1m		1M	Hz	Limited by frequency setting while modulation source is "Internal"
FSK					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation Source	Internal/External				
Modulating wave	Square with 50% duty cycle				
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"
PSK					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation Source	Internal/External				
Modulating wave	Square with 50% duty cycle				
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"
PWM					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Pulse				
Modulation Source	Internal/External				
Modulating wave	Sine, Square, Ramp, Noise, Arb				
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"
Pulse width deviation resolution	6.67			ns	

### Burst Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Pulse, Noise, Arb				
Type	Count(1-1000000cycles), Infinite, Gated				
Carrier frequency	2m		BW	Hz	BW is the max. output frequency
Start/Stop phase	0		360	°	
Internal period	1μ		1000	s	
Trigger source	Internal, External, Manual				
Gated source	Internal/External				
Trigger delay			100	s	

### Sweep Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Type	Linear, Log				
Direction	Up, Down				
Carrier frequency	1μ		BW	Hz	BW is the max. output frequency
Sweep time	1m		500	s	
Trigger source	Internal, External, Manual				

## Specifications

### Frequency Counter Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Function	Frequency, Period, Positive/Negative pulse width, Duty cycle				
Coupling mode	AC, DC, HF REJ				
Frequency range	100m		200M	Hz	DC coupling
	10		200M	Hz	AC coupling
Input amplitude	100mVrms		±2.5V		DC coupling, < 100 MHz
	200mVrms		±2.5V		DC coupling, 100 MHz ~ 200MHz
	100mVrms		5 Vpp		AC coupling, < 100 MHz
	200mVrms		5 Vpp		AC coupling, 100 MHz ~ 200MHz
Input impedance		1M		Ω	

### Reference Clock Input/Output

#### Reference Clock Input

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency		10M		Hz	
Amplitude	1.4			Vpp	
Input impedance	5			kΩ	AC coupling

#### Reference Clock Output

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency		10M		Hz	Synchronized to internal reference clock
Amplitude	2	3.3		Vpp	HiZ load
Output impedance		50		Ω	

### Auxiliary In/Out Characteristics

#### Trigger Input

Parameter	Min.	Typ.	Max.	Unit	Condition
V <sub>IH</sub>	2		5.5	V	
V <sub>IL</sub>	-0.5		0.8	V	
Input impedance	100			kΩ	
Pulse width	100			ns	
Response time			100	ns	Sweep
			600	ns	Burst

#### Trigger Output

Parameter	Min.	Typ.	Max.	Unit	Condition
V <sub>OH</sub>	3.8			V	I <sub>OH</sub> = -8 mA
V <sub>OL</sub>			0.44	V	I <sub>OL</sub> = 8 mA
Output impedance		100		Ω	
Frequency			1	MHz	

#### Sync Output

Parameter	Min.	Typ.	Max.	Unit	Condition
V <sub>OH</sub>	3.8			V	I <sub>OH</sub> = -8 mA
V <sub>OL</sub>			0.44	V	I <sub>OL</sub> = 8 mA
Output impedance		100		Ω	
Pulse width		50		ns	
Frequency			10	MHz	

#### Modulation Input

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	0		50	kHz	
Input impedance	10			kΩ	
Amplitude@ 100% Modulation depth	11	12	13	Vpp	

## Specifications

### General Characteristics

#### Power

Parameter	Min.	Typ.	Max.	Unit	Condition
Voltage	100 - 240 Vrms ( $\pm 10\%$ ), 50 / 60 Hz 100 - 120 Vrms ( $\pm 10\%$ ), 400 Hz				
Power consumption		25.5	50	W	Dual channels, Sine, 1kHz, 10Vpp, 50 $\Omega$ load

#### Display

Parameter	Min.	Typ.	Max.	Unit	Condition
Color depth		24		bit	
Contrast ratio		350:1			
Luminance		300		cd/m <sup>2</sup>	
Touch panel type	Resistive				

#### Environment

Parameter	Min.	Typ.	Max.	Unit	Condition
Operating temperature	0		40	°C	
Storage temperature	-20		60	°C	
Operating humidity	5		90	%	$\leq 30$ °C
	5		50	%	40 °C
Non-operating humidity	5		95	%	
Operating altitude			3048	m	$\leq 30$ °C
Non-operating altitude			15000	m	

#### Calibration

Parameter	Min.	Typ.	Max.	Unit	Condition
Calibration interval		1		year	

#### Mechanical

Parameter	Min.	Typ.	Max.	Unit	Condition
Dimensions	W×H×D = 260.3mm×107.2mm×295.7mm				
Net weight		3.43		kg	
Gross weight		4.42		kg	

#### Compliance

LVD	IEC 61010-1:2010
EMC	EN61326-1:2013

## Ordering Information

Product Description	SDG2000X Series Function/Arbitrary Waveform Generator
Product code	SDG2122X 120MHz
	SDG2082X 80MHz
	SDG2042X 40MHz
Standard configurations	A Quick Start、A Power Cord、A USB Cable、A CD ( Including Quick Start, data sheet, and Application Software Package )、A Calibration Certificate, A BNC Coaxial Cable
Optional configurations	USB-GPIB adapter 20dB Attenuator SPA1010 10W Power Amplifier