



**The Best Value in Electronic Test & Measurement**

# SDG6000X Series

## Function/Arbitrary Waveform Generator

2017-11



# Multiple Waveform Generator

- Maximum frequency up-to 500 MHz
- Fast Rise/Fall Time
- Function/Arbitrary Waveform Generator
- I/Q Waveform Generator (Optional)
- PRBS Waveform Generator
- Noise Waveform Generator
- High-Precision Counter
- Complex signal Output

# Overview

- Continuous waveform generation
  - Up-to 500 MHz continuous sine wave
  - Max Sample Rate of 2.4 GSa/s
  - Maximum Output Amplitude of 20 Vpp
- Pulse Generation
  - EasyPulse Technology
  - Rise/Fall time down to 1 ns
  - Adjustable pulse width
  - Low jitter
- Function/Arbitrary Waveform Generation
  - TrueArb Technology
  - Max Arbitrary Depth up-to 20 Mpts
  - Point-by-point output plays every sample
  - 196 built-in arbitrary waveforms



# Overview

- IQ signal generation
  - Proprietary technology provides excellent EVM performance at arbitrary symbol rates between 250 Symb/s ~ 37.5 MSymb/s.
- Noise signal generation
  - Gaussian noise with bandwidth up to 500 MHz
- High-precision frequency meter
  - 8 digits
- Complex signal generation
  - Modulation: AM/FM/PM/ASK/FSK/PSK/DSB-AM/PWM
  - Sweep & Burst
  - Waveform combining
  - Harmonics Function
- 4.3 inch touch screen

# SDG6000X Model and Key Features

|                           | SDG6022X   | SDG6032X        | SDG6052X |
|---------------------------|--|-----------------|----------|
| Bandwidth                 | 200 MHz  | 350 MHz         | 500 MHz  |
| Number of channels        | 2 CH   |                 |          |
| Sampling rate             | 2.4 GSa/s  |                 |          |
| Vertical resolution       | 16-bit   |                 |          |
| Pulse rise/fall time      | 2 ns   | 1 ns            |          |
| Frequency resolution      | 1 uHz  |                 |          |
| Frequency accuracy        | $\pm 1$ ppm  |                 |          |
| Arbitrary waveform length | 2 – 20 Mpts  |                 |          |
| Pulse waveform            | 1 uHz – 80 MHz   | 1 uHz – 150 MHz |          |
| Square                    | 1 uHz – 80 MHz   | 1 uHz – 120 MHz |          |
| Ramp                      | 1 uHz – 5 MHz  |                 |          |
| Noise                     | 200 MHz  | 350 MHz         | 500 MHz  |
| Arbitrary waveform        | 196 kinds, including Sinc, Exponential Rise, Exponential Fall, ECG, Gauss, Haver Sine, Lorentz |                 |          |

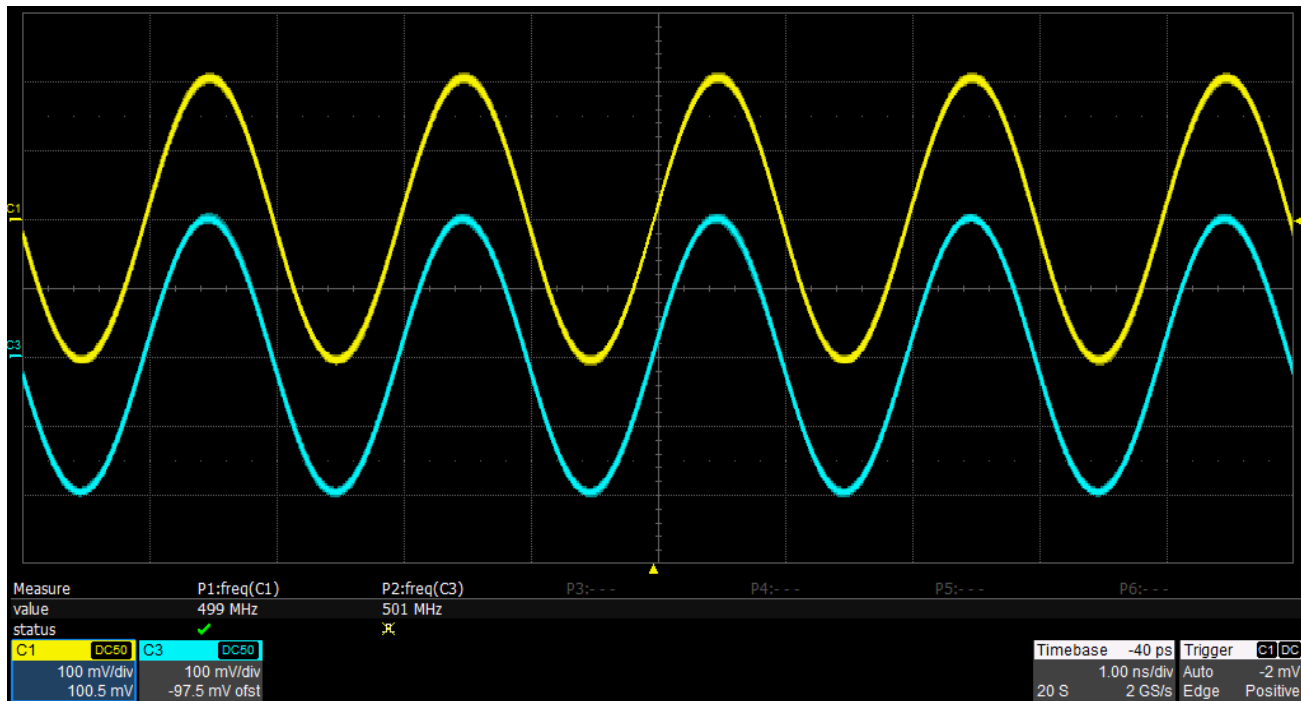
# SDG6000X Model and Key Features

|                   | SDG6022X                                | SDG6032X | SDG6052X |
|-------------------|---|----------|----------|
| Amplitude         | 2 mVpp to 20 Vpp                        |          |          |
| Advanced function | AM\FM\PM\ASK\PSK\FSK\PWM\Sweep\Burst    |          |          |
| IQ wave source    | Support                                 |          |          |
| PRBS              | Support                                 |          |          |
| Frequency counter | 0.1 Hz – 400 MHz, 8 digits              |          |          |
| Interface         | USB Host & Device, LAN, GPIB (optional) |          |          |
| Display           | 4.3 inch (480*272) touch screen         |          |          |



# Continuous Wave Generator

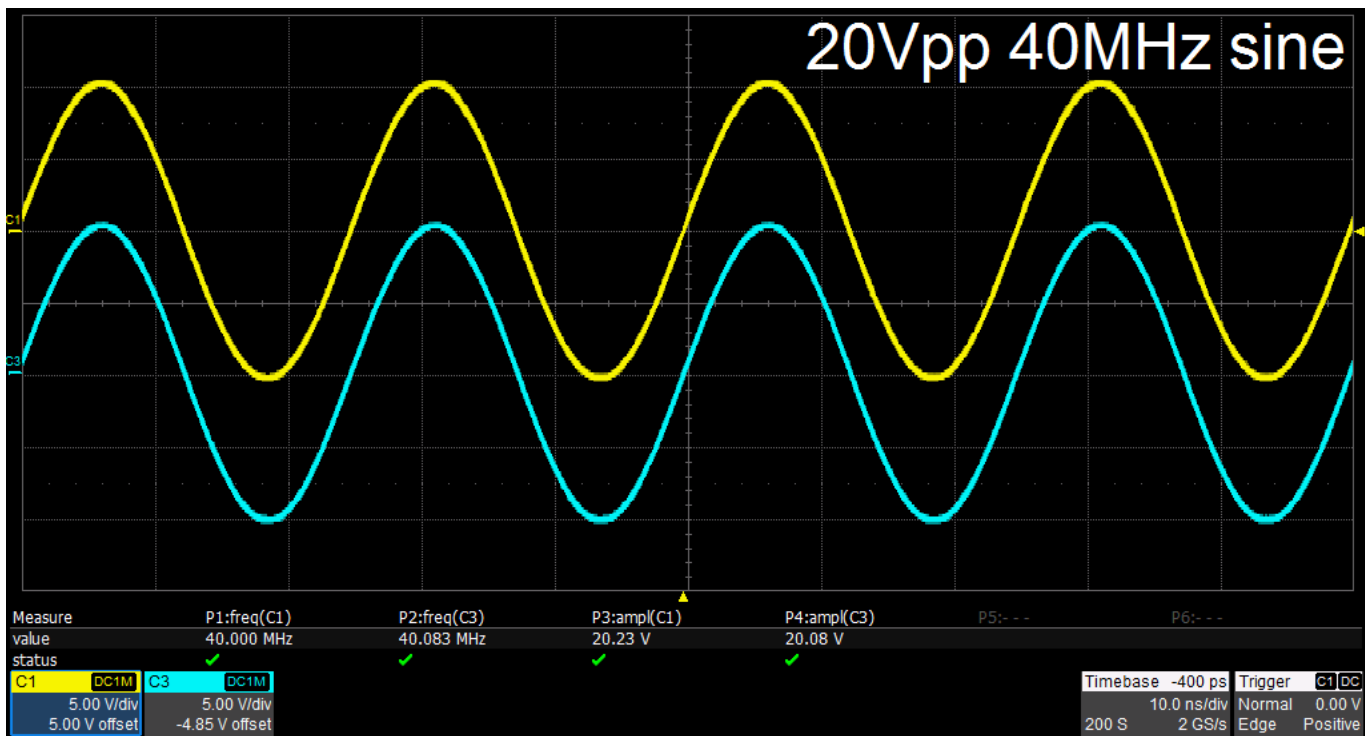
- Up-to 500 MHz continuous sine wave





# Continuous Wave Generator

- Source high amplitudes even at high frequencies



# Continuous Wave Generator

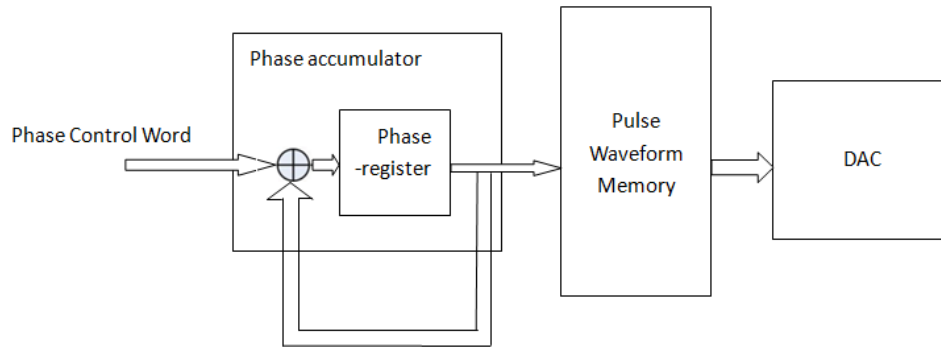
- Small signal output down to 1 mVpp, improves signal-to-noise ratio



# Pulse Generator

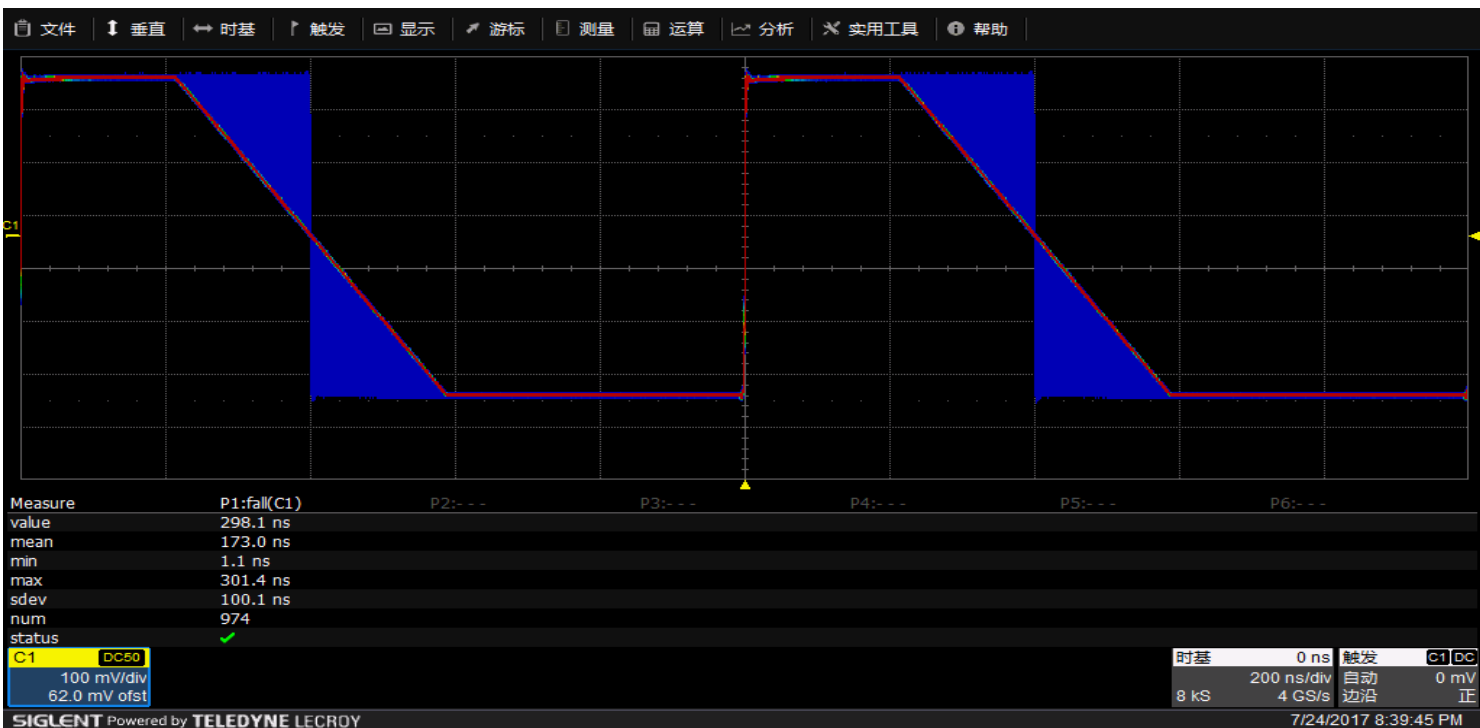
- EasyPulse Technology features:
  - Adjustable width, fine control (1 ns) of rising and falling edges
  - Low jitter Square/Pulse waveforms
- EasyPulse Technology

Traditional DDS technology suffers from jitter and coarse rise/fall control. EasyPulse Technology adds increased adjustment to pulse edges and width:



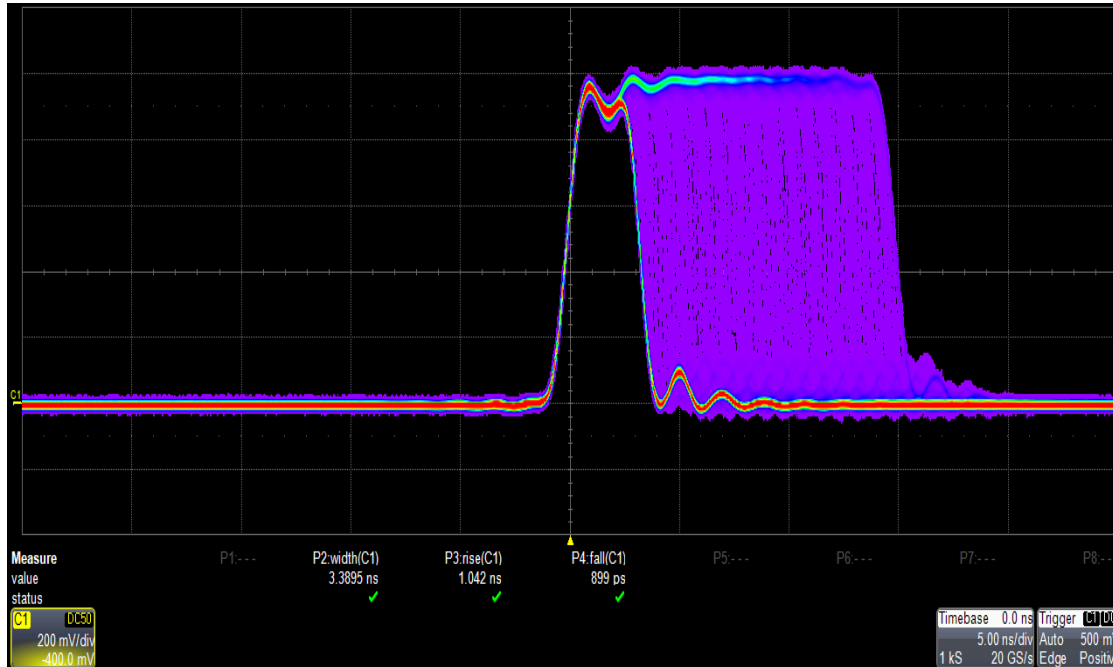
# Pulse Generator

- The rise/fall time can be set independently to the minimum of 1 ns at any frequency with a minimum adjustment step as small as 100 ps.



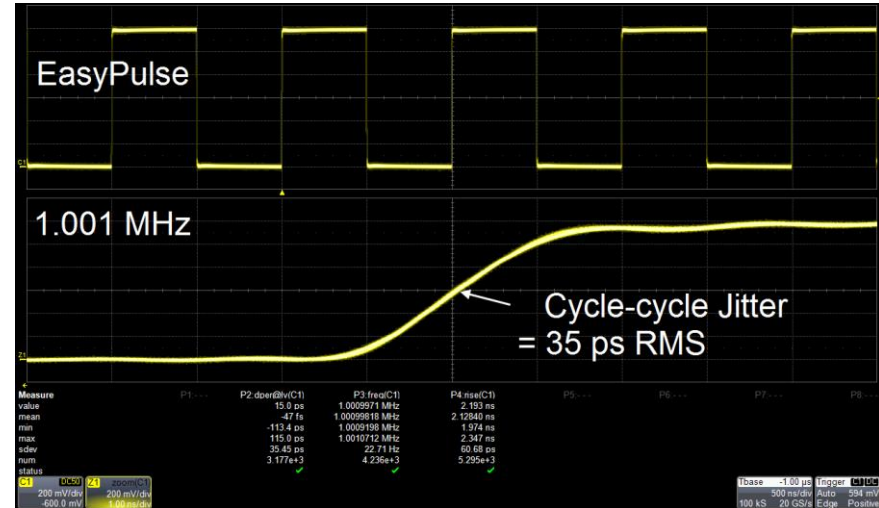
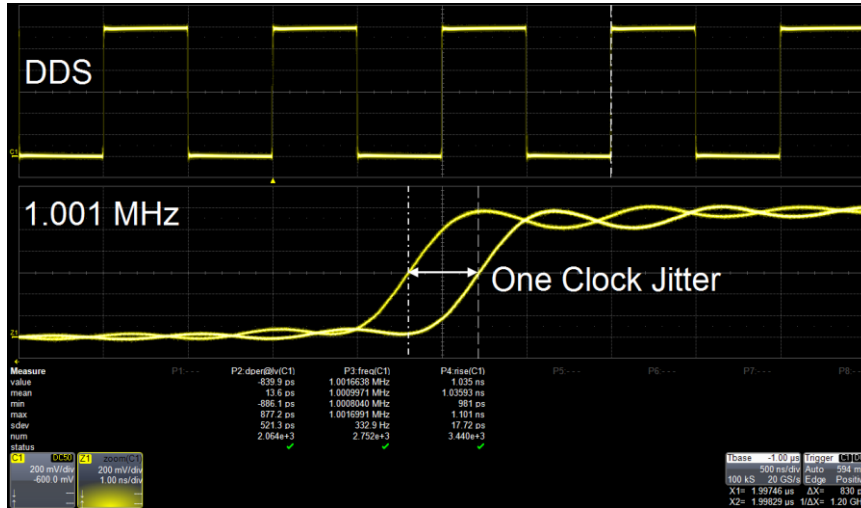
# Pulse Generator

- The pulse width can be fine-tuned to the minimum of 3.3 ns with an adjustment step as small as 100 ps, at any frequency.



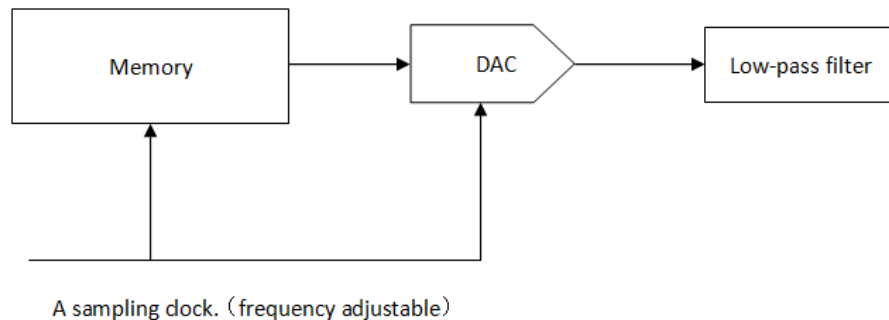
# Pulse Generator

When a Square/Pulse waveform is generated by traditional DDS, there can be additional jitter if the sampling rate is not an integer multiple of the output frequency. EasyPulse Technology successfully overcomes this weakness in DDS designs and helps to produce low jitter square/pulse waveforms.



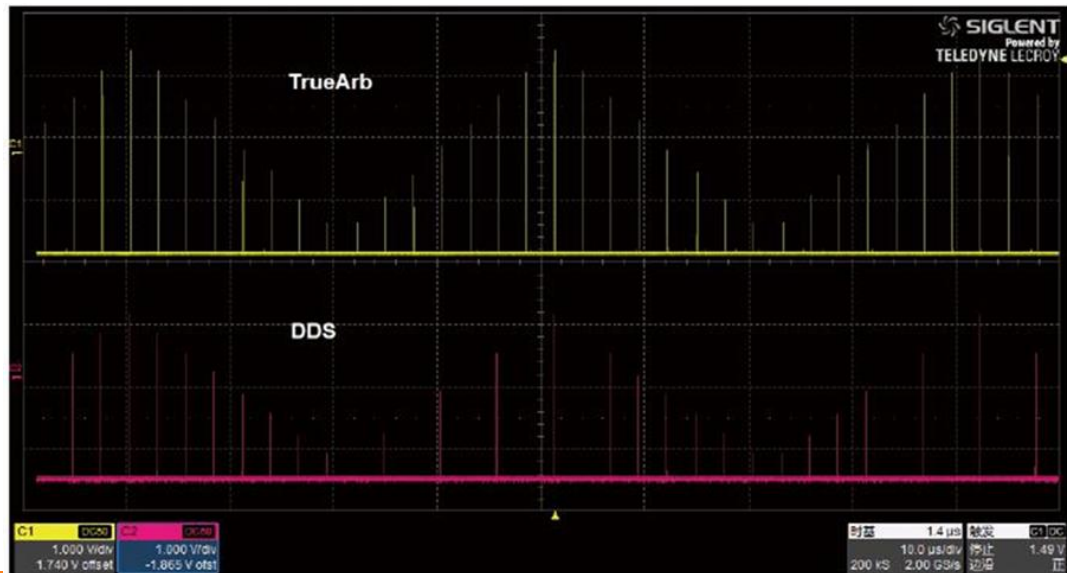
# Arbitrary Waveform Generator

- TrueArb technology delivers an arbitrary function with the following features:
  - TrueArb generates arbitrary waveforms point-by-point. It never skips any points so that it can reconstruct every waveform detail.
  - Lower clock jitter than traditional DDS generators.



# Arbitrary Waveform Generator

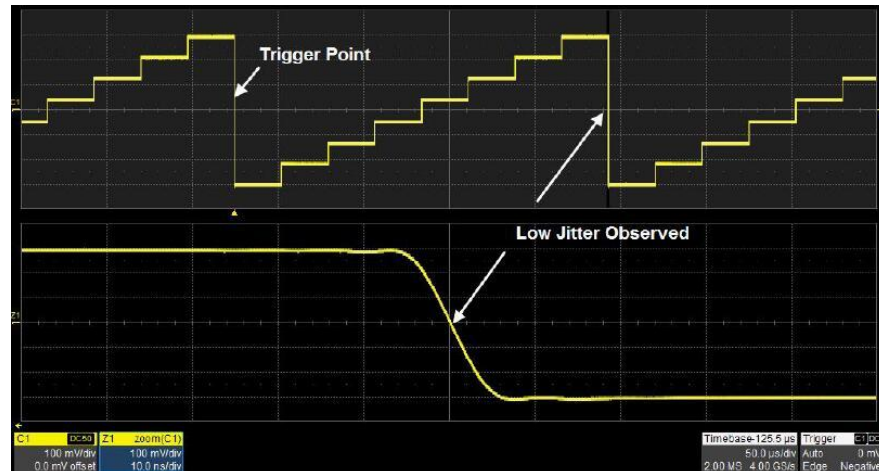
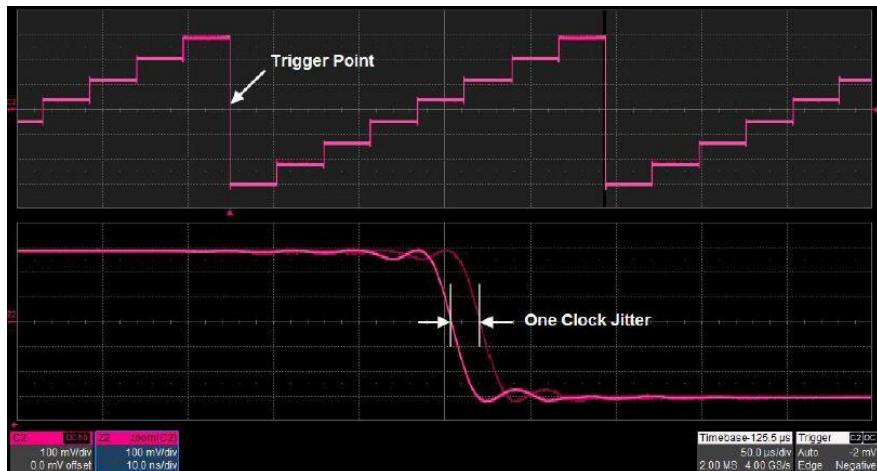
- Point-by-point output, minimizes distortion
- When a Square/Pulse waveform is generated by traditional DDS, there may be a few missing details if the sampling rate is not an integer multiple of the output frequency.
- Sampling rate 1  $\mu$  – 300 MSa/s





# Arbitrary Waveform Generator

TrueArb design minimizes jitter and distortion

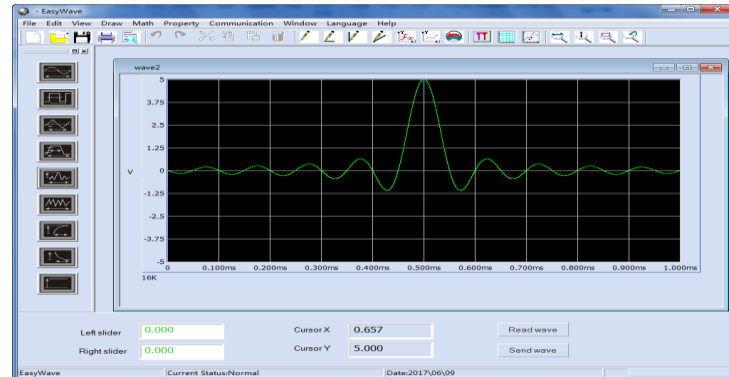


# Arbitrary Waveform Generator

- 196 built-in arbitrary waveforms
- Up to 20 Mpts point-by-point output
- Supports TrueArb and DDS waveform modes
- Includes EasyWave software for waveform creation and editing. It features manual drawing, as-well-as line, equation, and coordinate editing modes.

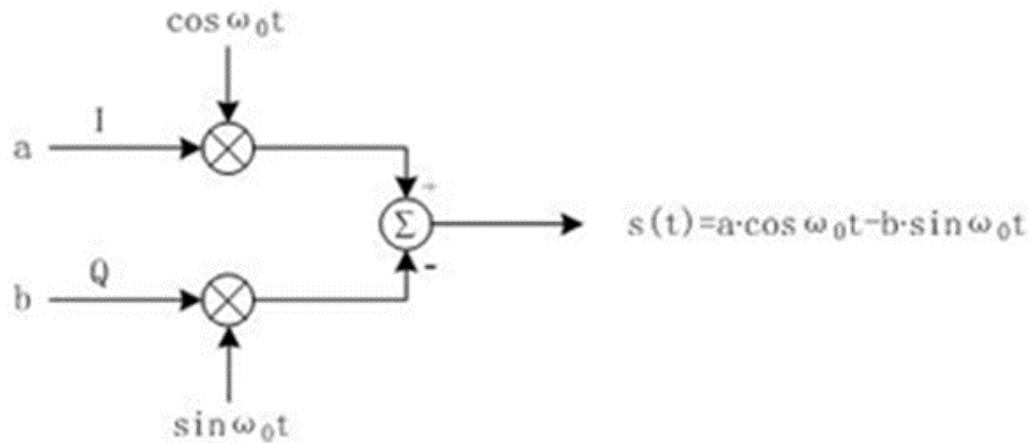
| *CH1: Arb.ON.50Ω |           |           | CH2: Sine.OFF.HiZ |          |
|------------------|-----------|-----------|-------------------|----------|
| ExpFall          | ExpRise   | LogFall   | LogRise           | Sqrt     |
| Root3            | X^2       | X^3       | Airy              | Besselj  |
| Bessely          | Dirichlet | Erf       | Erfc              | Erfclnv  |
| ErfInv           | Laguerre  | Legend    | Versiera          | Sinc     |
| Gaussian         | Dlorenz   | Haversine | Lorentz           | Gauspuls |
| Gmonopuls        | Tripuls   | Weibull   | LogNormal         | Laplace  |
| Maxwell          | Rayleigh  | Cauchy    |                   |          |

Common Math Engine Window Trigo Page 1 / 3



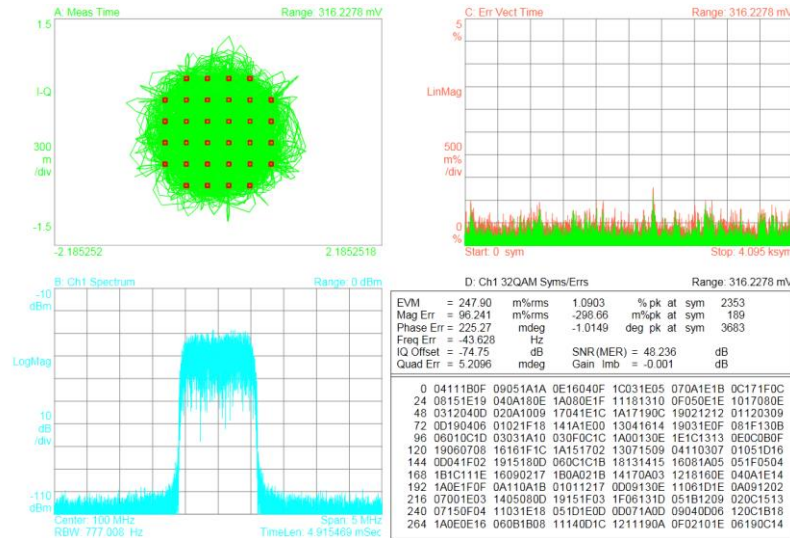
# IQ Signal Generator

- IQ modulation (optional)
- Baseband and IF signal generation
- Theory: I channel and Q channel output data a and data b respectively, I signal multiplies  $\cos\omega_0t$ , Q signal multiplies  $\sin\omega_0t$ , then output IQ modulated signal after superposition.



# IQ Signal Generator

- Includes: ASK, FSK, PSK and QAM modulation
- Excellent EVM performance at arbitrary symbol rates between 250 Symb/s ~ 37.5 M Symb/s.
- Built-in digital quadrature modulator provides the possibility to generate IQ signals from baseband to 500 MHz intermediate frequency.



# IQ Signal Generator

- Available modulation types: 2ASK, 4ASK, 8ASK, BPSK, QPSK, 8PSK, DBPSK, DQPSK, D8PSK, 8QAM, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM
- Supports PN7, PN9, PN15, PN23, and user data source files

The screenshot displays the configuration interface for the IQ Signal Generator, divided into two main sections: Data Source and Modulation.

**Data Source:**

- Data Setup: PN9
- Symbol Length: 512 Symbol
- Symbol Rate: 1000000 Symbol/s
- Bits per Symbol: 8

**Modulation:**

- APSK & QAM: 256QAM
- MFSK: 2FSK
- Multitone: [disabled]
- Custom: [disabled]

Gray: [disabled] OFF

On the right side, there is a constellation diagram showing a grid of yellow dots representing the signal points in the complex plane. The axes range from -1 to 1 on both the real and imaginary axes.

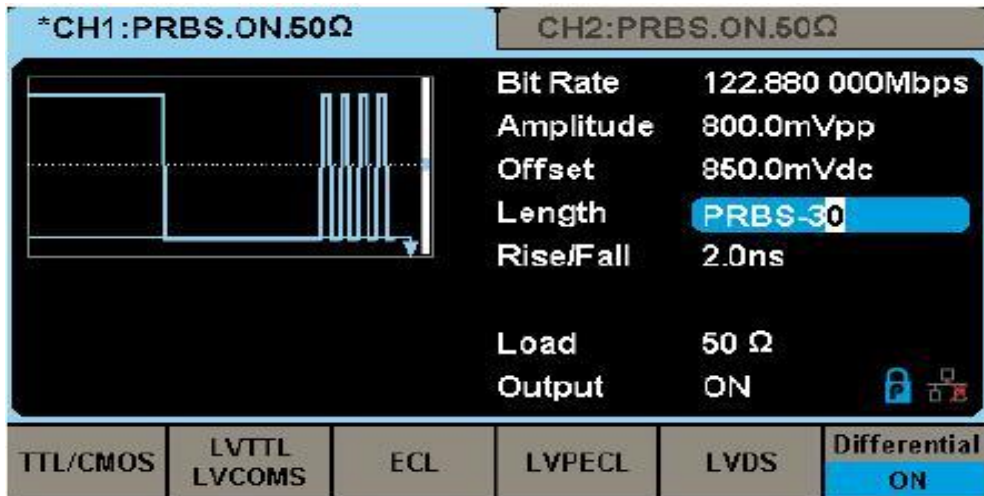
# IQ Signal Generator

- Includes EasyIQ software to generate ASK, BPSK, QAM, FSK, MSK, and Multi-tone signals, view waveform details, and download to the SDG6000X



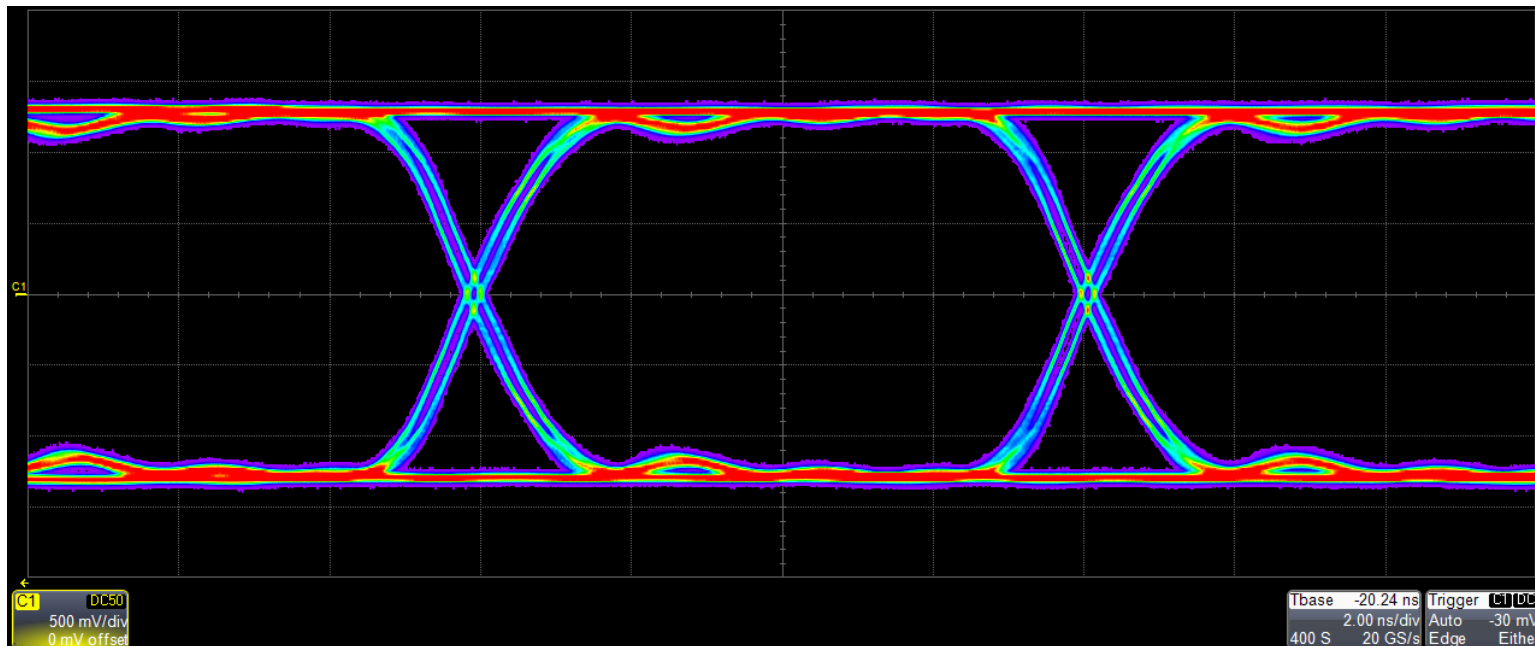
# PRBS Generator

- PRBS (Pseudo Random Binary Sequence) generates “random” bit pattern.
- Provides rich PRBS patterns for serial bus physical layer testing.



# PRBS Generator

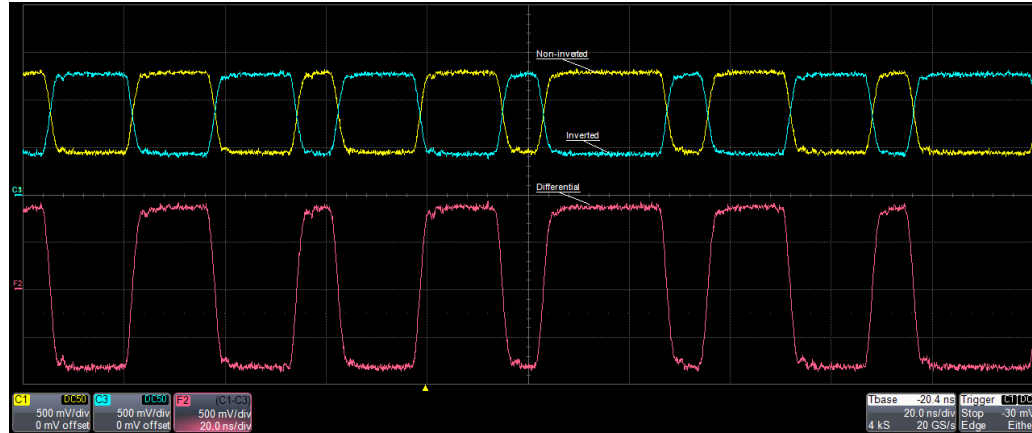
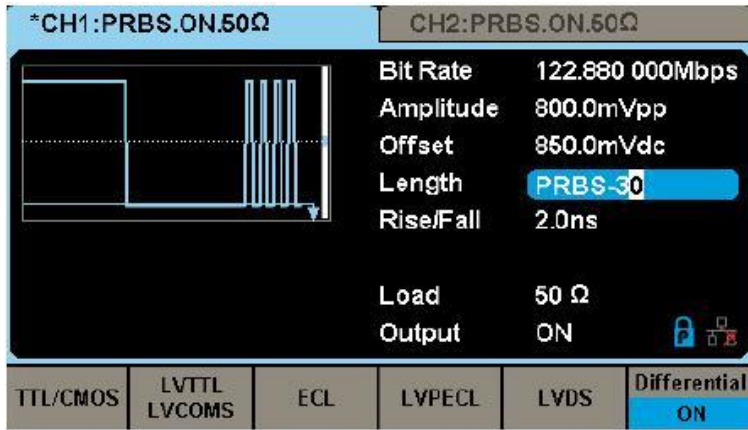
- PRBS3 ~ PRBS32 with finely adjustable 10-6 bps ~ 300 Mbps bit rate and 1 ns ~ 1  $\mu$ s edge.





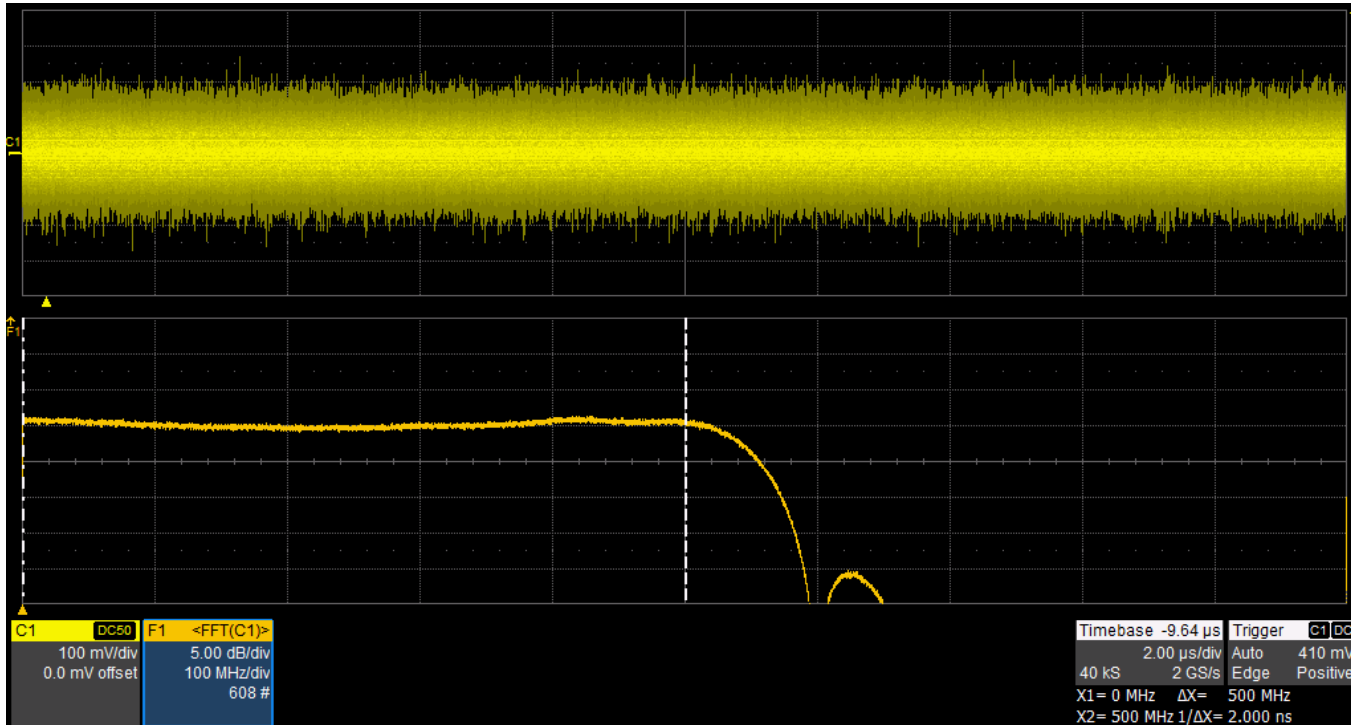
# PRBS Generator

- Preset common logic levels such as TTL, LVCMOS, LVPECL and LVDS. An added differential mode provides an easy way to generate differential signals using the both channels.



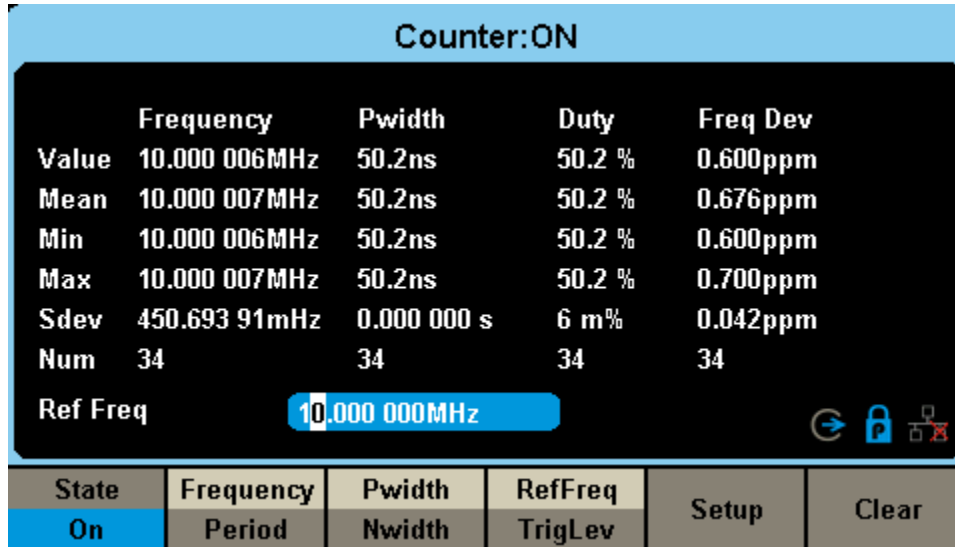
# Noise Generator

- Gaussian noise with bandwidth up to 500 MHz. The repetition period is more than 100 years, and the bandwidth is adjustable.



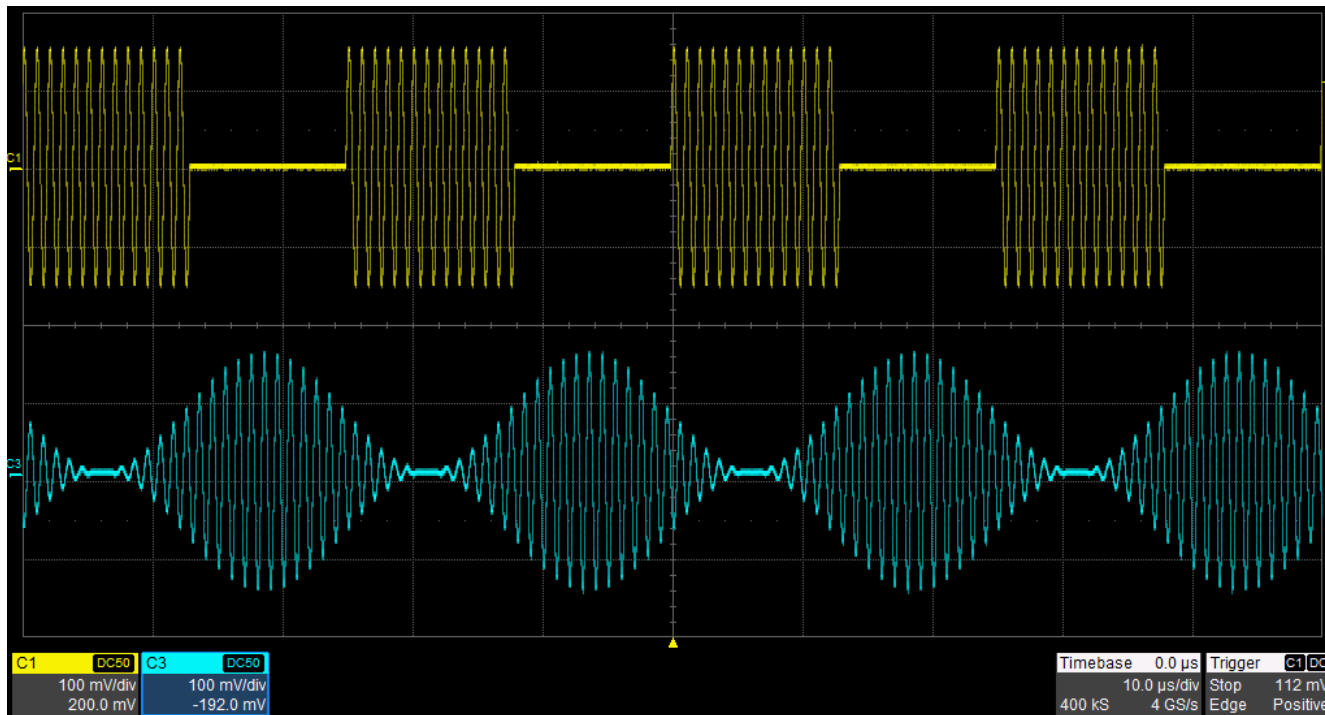
# High-precision Counter

- 8-digit hardware frequency counter with statistics function and input range of 0.1 Hz ~ 400 MHz .



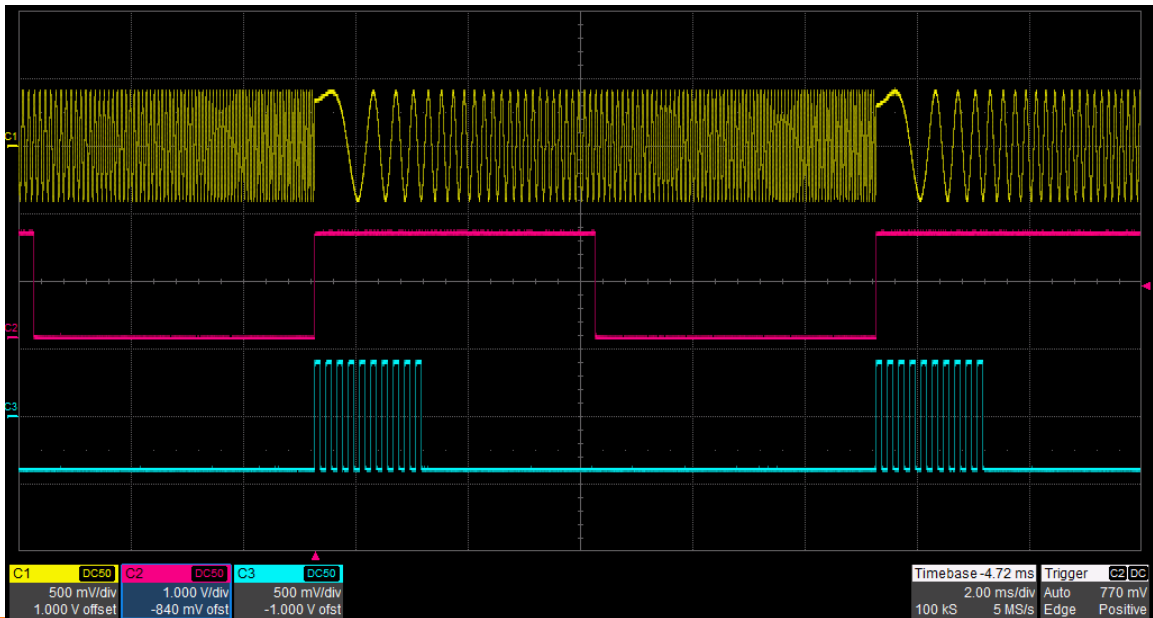
# Complex Signals Generation

- Standard modulation types, such as AM, FM, PM, FSK, ASK, PSK, DSBAM, PWM are supported. The modulation source can be configured as "Internal" or "External" .



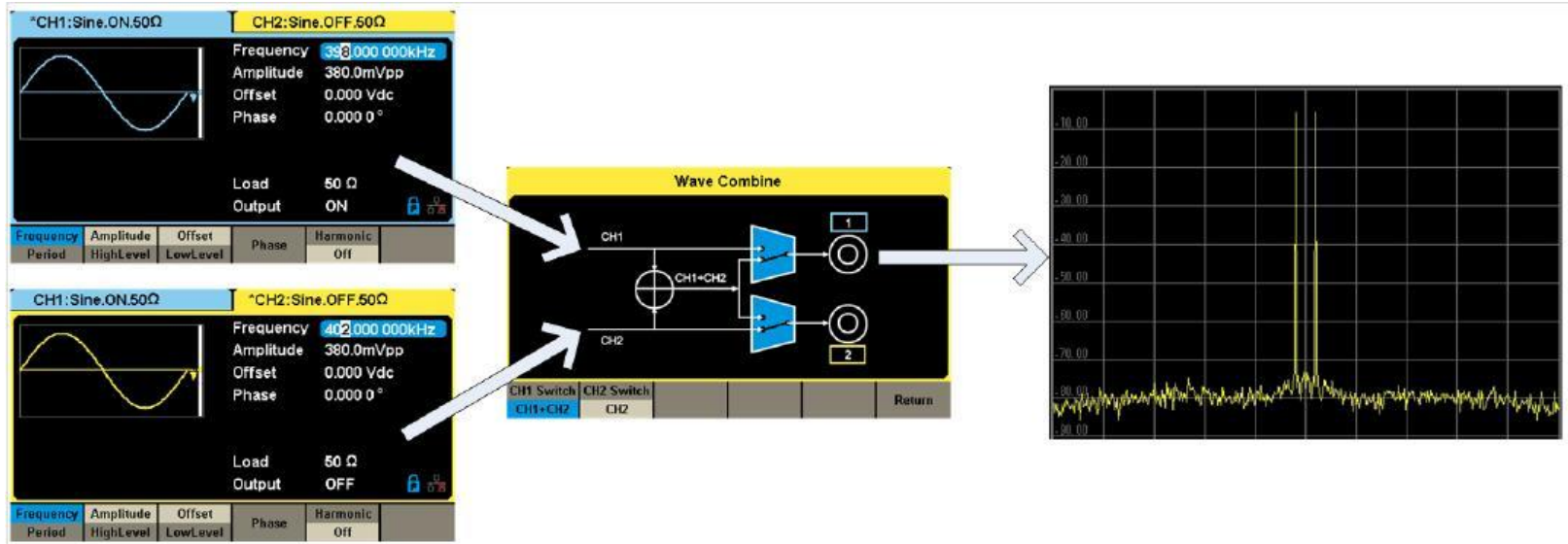
# Complex Signals Generation

- Sweep modes include "Linear" and "Log" .
- Burst modes includes "N cycle" and "Gated" .
- Both Sweep and Burst can be triggered by "Internal" , "External" or "Manual" source.



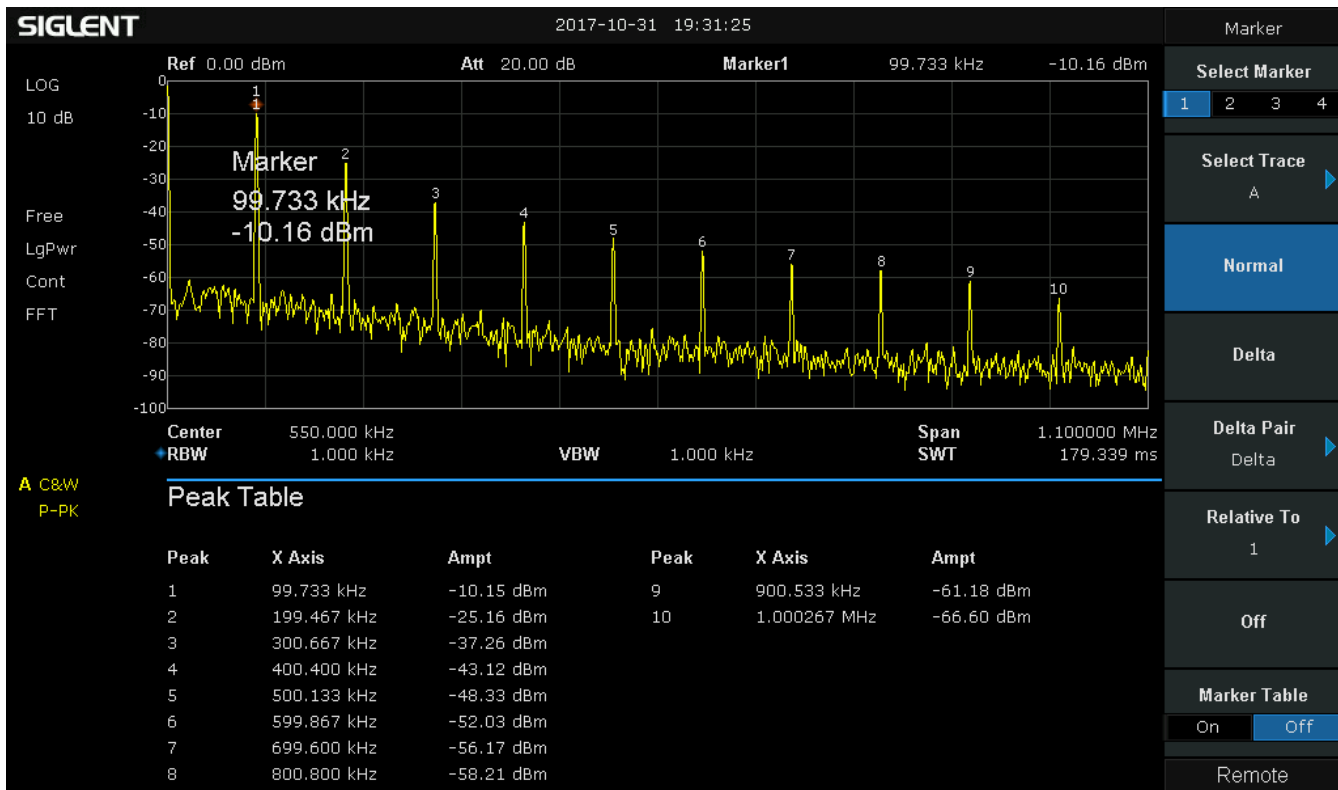
# Complex Signals Generation

- **Waveform Combine:** Superimposes CH1 and CH2 waveforms internally and provides the combined waveform to a user-selected output.
- Easily combine basic waveforms, random noise, modulation signals, sweep signals, burst signals, EasyPulse waveforms and TrueArb waveforms.



# Complex Signals Generation

SDG6000X harmonic generation up-to-the 10<sup>th</sup> harmonic



# SDG6000X Ordering Information

| Description   | Order Number |
|---|--------------|
| 500 MHz, 2-CH, 2.4 GSa/s, 16-bit, 4.3 inch touch screen | SDG6052X     |
| 350 MHz, 2-CH, 2.4 GSa/s, 16-bit, 4.3 inch touch screen | SDG6032X     |
| 200 MHz, 2-CH, 2.4 GSa/s, 16-bit, 4.3 inch touch screen | SDS6022X     |

## Optional Accessories

|                         |                     |
|-------------------------|---------------------|
| 10W Power Amplification | SPA1010             |
| 20 dB Attenuator        | ATT – 20dB          |
| SDG – 6000X - IQ        | IQ Signal Generator |
| USB-GPIB Adapter        | USB-GPIB            |





# Thank You!

The Best Value in Electronic Test & Measurement