

Задумывались ли Вы о возможностях Вашего функционального генератора?

Серия 33500В Генераторов функций/сигналов произвольной формы



Генераторы функций– Базовые возможности

waveform –форма сигнала

Синус



Меандр



Пила



Треугольник



Импульс



Шум



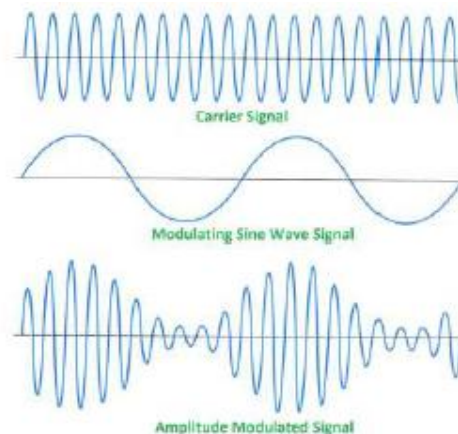
Произвольный



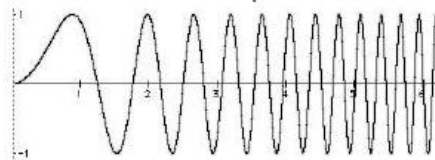
Со смещением



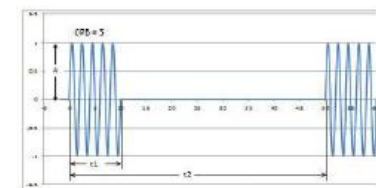
Модуляция



Свирированный



Импульсный



Сигналы и их формы

Типы формы сигналов:

1. *Функции*: (базовые) синусоидальный, меандр, пилообразный

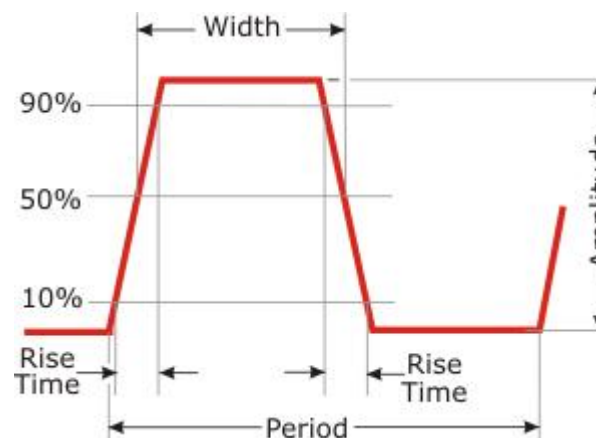
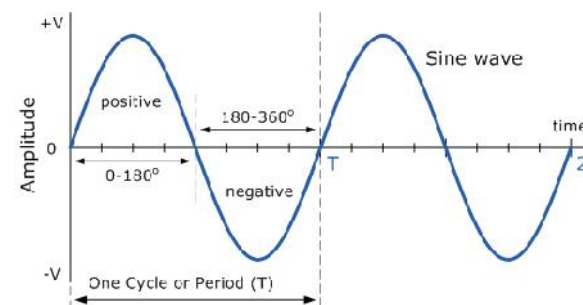
точно описываются математической функцией, обычно периодические

2. *Импульсные*: прямоугольной формы

типа меандра, но с большей гибкостью формирования (например, ШИМ)

3. *Произвольной формы*: реальные сигналы со сложной формой

4. *Шум*: случайный, широкополосный



Короткая историческая справка



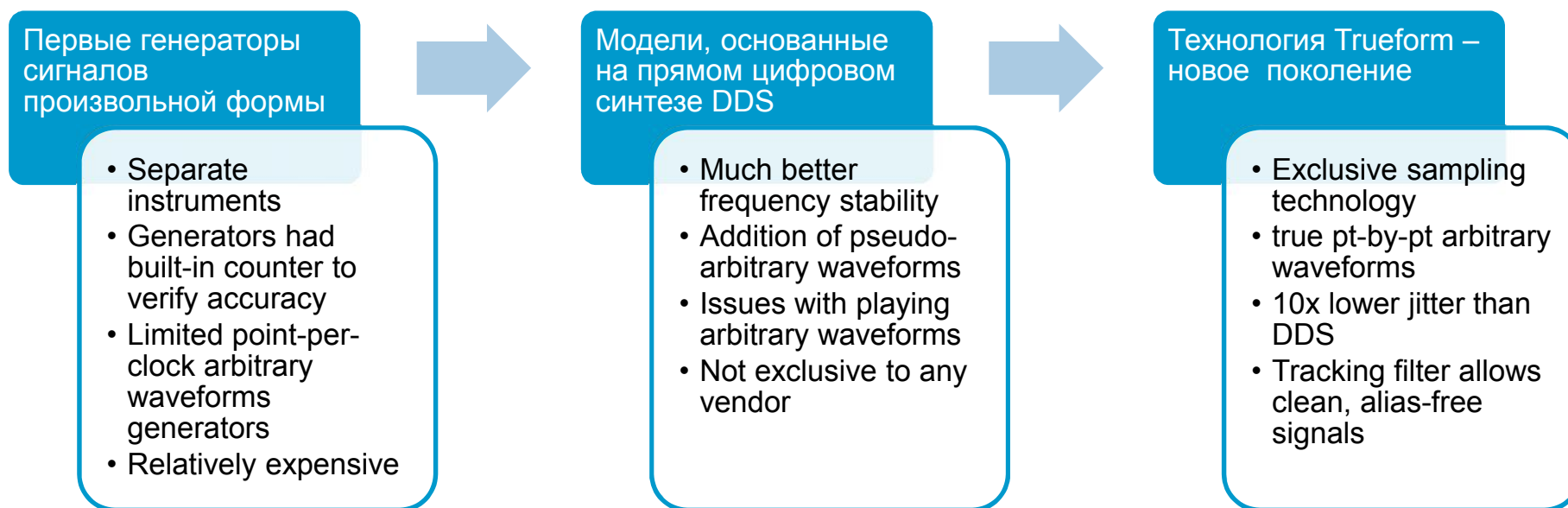
Около 75 лет назад Билл Хьюлетт и Дейв Пакард создали первый инструмент HP – генератор ЗЧ 200A Audio Oscillator. Это был первый из последующих многочисленных линеек генераторов сигналов HP и Agilent.



Agilent 33500B Series, семейство генераторов с частотой 20 и 30 MHz представленное August 2012, продолжает традиции надежных высококлассных и, вместе с тем, бюджетных приборов Agilent.

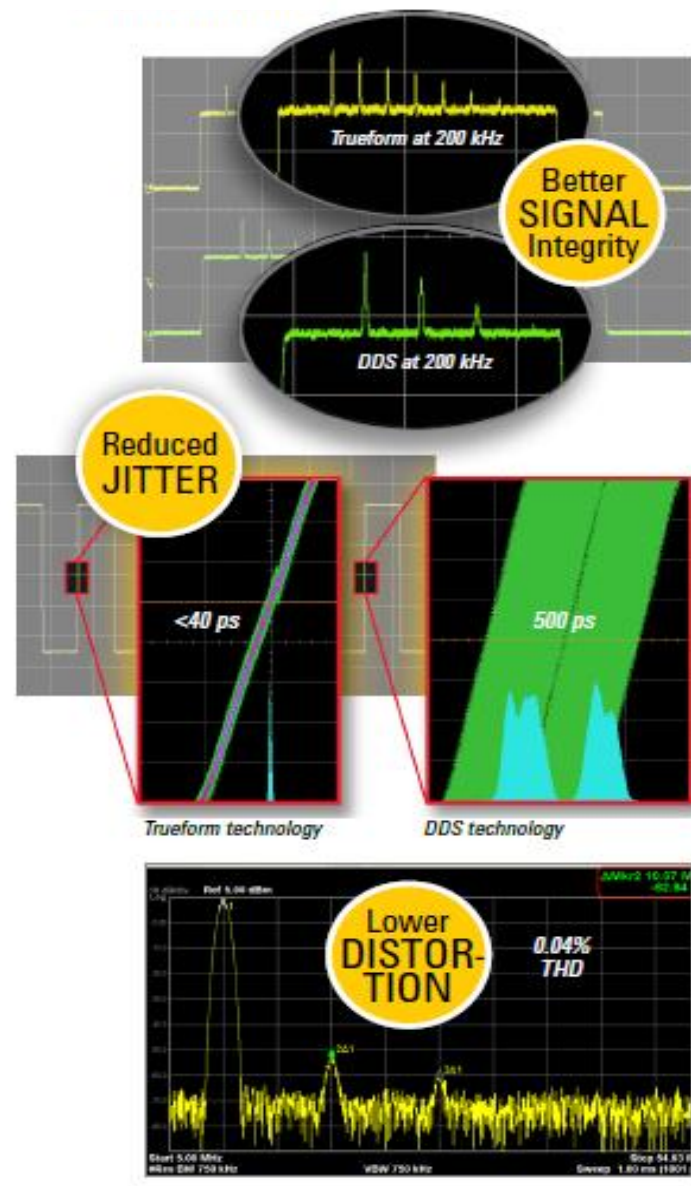


Эволюция генераторов сигналов произвольной формы



Trueform Technology

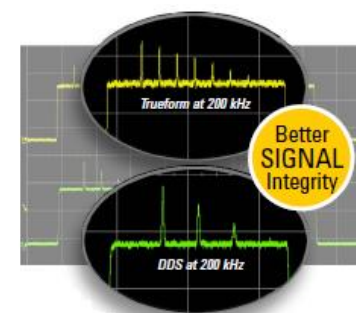
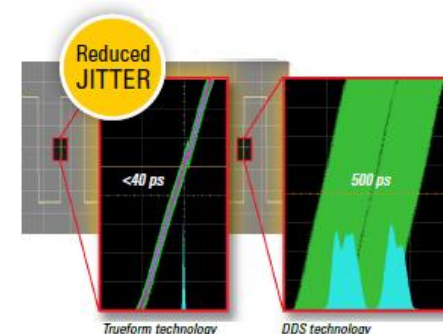
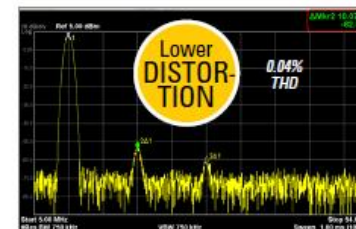
- Новая эксклюзивная технология Trueform генерирования сигналов от Agilent's обеспечивает непревзойденную точность и целостность сигналов.
- Теперь пользователи могут генерировать сигналы именно той формы, которая им требуется.



33500В Trueform Waveform Generators

3 основных качества

1. Trueform обеспечивает **самые низкие искажения**, - гармонические и негармонические, формируя сигнал с высокой спектральной частотой.
2. Trueform характеризуется **самым низким джиттером**, <40 ps, обеспечивая прецизионное позиционирование фронтов импульсных и прямоугольных сигналов.
3. Trueform это **истинное поточечное формирование сигнала произвольной формой**, позволяющее создать сигнал именно той формы, которая требуется.



Портфолио генераторов произвольной формы



Frequency range	Model number	► Why buy? 1-minute sell	Functions					AWG (Arb)	Channels		Patterns	Connectivity			Starting price USD		
			Sine, Square, Ramp	Pulse	Noise, Modulation	Sin(x)/X, Cardiac, Exponential	Gaussian noise	Arbitrary wave form, number of points	Number of channels	Dual tone, Dual channel coupling	IQ generator	PRBS	Patterns	Differential output(s)		GPIO	LAN (LXI)
1 MHz - 10 MHz	33210A	- Agilent's lowest cost solution for < 10 MHz signal generation - Low-distortion, accurate signals (0.04% THD)	■	■	■			DDS, 8 K optional	1					■	■	■	\$1,279
1 µHz - 20 MHz	33220A	Same low distortion, accurate signals as 33210A plus arb standard (Recommend 33519B lower cost, superior capability)	■	■	■	■		DDS, 64 K	1					■	■	■	\$2,252
1 µHz - 80 MHz	33250A	Agilent's lowest cost solution for > 30 MHz to 80 MHz	■	■	■	■		DDS, 8 K	1					■			\$4,798
1 µHz - 20 MHz, 1 µHz - 30 MHz	33500B, 33510B, 33511B, 33512B, 33510B, 33520B, 33521B, 33522B	- Best ≤ 30 MHz signal generation on the market - Best signal fidelity (<0.04% THD, < 40 ps jitter) - Superior arbitrary waveforms with Trueform signal technology - Choose the model with the features you need	■	■	■	■	■	Trueform, 1 M; 16 M optional	1,2	■	■ ¹	7...23	■ ²	■	■	■	\$1,653 to \$3,256
1 µHz - 240 MHz	81150A	Extensive External In, Modulation In and Trigger/Strobe capabilities for automated testing	■	■	■		■	DDS, 512 K	1,2	■		7...31	■	■	■	■	\$10,937
1 µHz - 500 MHz	81160A	- Close to real world noise generation for worst-case scenarios - Pattern generator to test analog, digital and mixed signal devices	■	■	■	■	■	DDS, 256 K	1,2	■		7...31	■	■	■	■	\$18,217
1 µHz - 660 MHz	81100A, 81130A Families	- Standard pulses and digital patterns to test current logic technologies (CMOS, TTL, LVDS, ECL, etc) - Multi-level and multi-timing signals can be obtained with internal channel addition feature		■			■	DDS, 64 K	1,2	■		7...15	■	■	■		\$9,824

1 IQ baseband generator is optional for 33512B & 33522B only

2 Customer defined pattern generation available using optional Waveform Builder Pro software



Agilent 33500B Series Waveform Generators

Agilent's 33500B Series of Waveform Generators with exclusive Trueform Technology offer more capability, fidelity and flexibility than traditional DDS waveform generators. Eight new upgradeable models are available at 20 and 30 MHz with 1- and 2-channels with a full set of standard features, and optional baseband I-Q signal player.

- Sine waves with 5x lower harmonic distortion
- Pulses up to 30 MHz with 10x less jitter
- Point-by-point arbitrary waveforms with sequencing
- 16 bits of resolution with 1 mVpp to 10 Vpp amplitude



Key features and benefits:

- Superior signal integrity with Trueform technology providing highest resolution and lowest distortion
- Flexibility to select needed functionality from eight new value-priced models, with ability to upgrade later when your needs change
- Superior user experience with intuitive front panel, complimentary software and localized help and manuals, and access to manuals from mobile devices

Key characteristics:

- Up to 30 MHz sine and pulse
- **Jitter:** < 40 ps
- **THD:** < 0.04%
- **Amplitude ranges:** 1 mVpp up to 10 Vpp
- 250 MSa/s sampling rate
- 16-bit amplitude resolution
- 1 MSa/channel memory, 16 MSa optional



Quick Fact Sheet

Agilent 33500B Series Waveform Generators

Step 1.

Choose your bandwidth, number of channels, and arbitrary waveforms

Waveform generator	33509B	33510B	33519B	33520B
Bandwidth	20 MHz	20 MHz	30 MHz	30 MHz
Number of channels	1	2	1	2

Waveform generator with arb	33511B	33512B	33521B	33522B
Bandwidth	20 MHz	20 MHz	30 MHz	30 MHz
Number of channels	1	2	1	2

Step 2.

Tailor your generator for more demanding applications

Application	Order option
Additional memory for long waveforms	MEM (only available on models with arb)
Baseband IQ Player with adjustments	IQP (only available on 33512B/33522B)
Security features with NISPOM	SEC
Ultra-high stability timebase	OCX

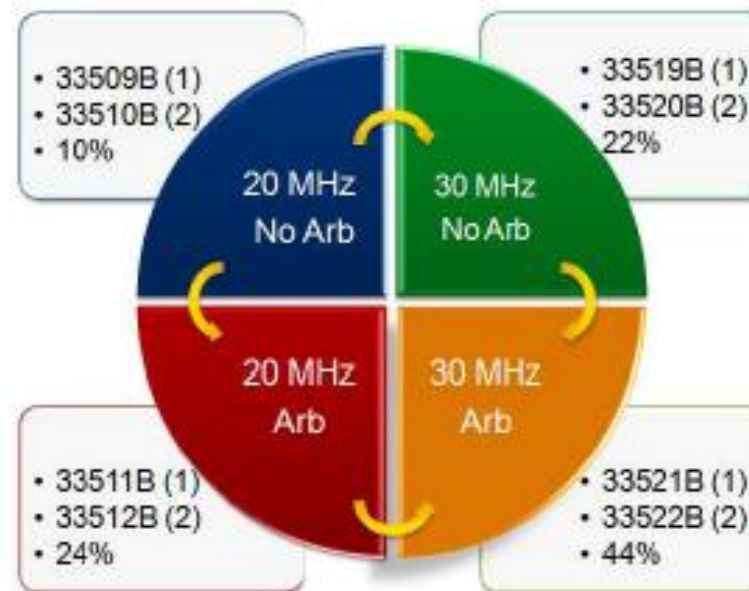
For more details on the *Agilent 33500B Series waveform generators*, see the brochure, Literature number: 5991-0757EN

For more information on *Agilent function/arbitrary waveform generators*, please visit: www.agilent.com/find/functiongenerators

To find a distributor in your area, go to www.agilent.com/find/distributors

Recommended service options

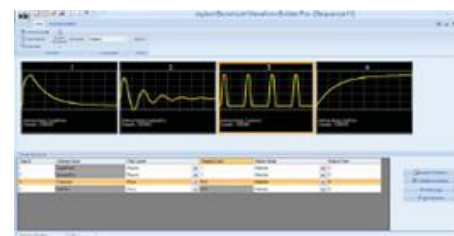
Additional two years of Return-to-Agilent warranty
Additional two years of Return-to-Agilent calibrations
For more information go to www.agilent.com/find/removealldoubt



\$250 per channel
\$900
\$100
\$700

Note:

All options have upgrade/retrofit products available with same pricing

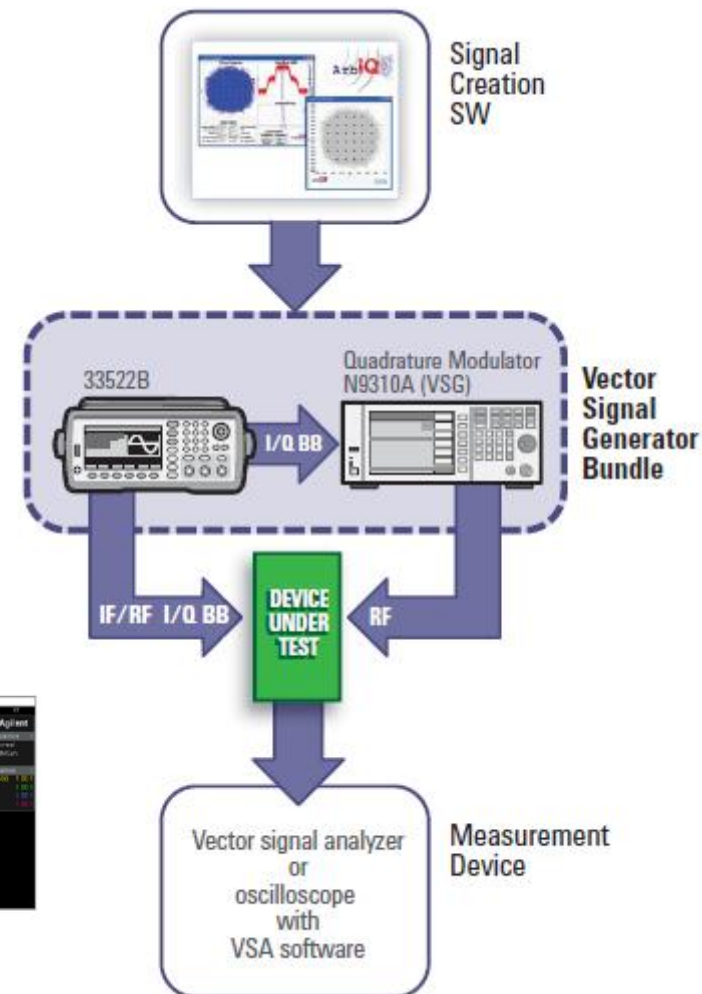
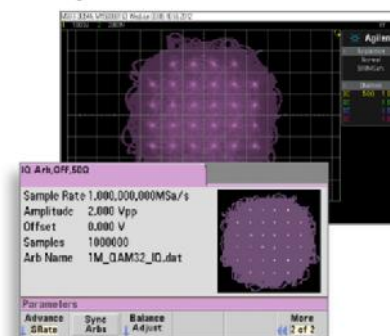


Also have value-add **software**:
BenchLink Waveform Builder SW
BenchLink Waveform Builder Pro SW
(\$750)



Бюджетный вариант формирования IQ: 33522B & N9310A

1. MATLAB или друго пакет ПО формирования IQ сигналов
2. 33522B с опцией IQ player и генератор N9310A с опцией IQ ВХОДОВ
3. Векторный анализатор сигналов или осциллограф с пакетом VSA



33503A BenchLink Waveform Builder Pro

Fast and Easy Analysis Tools for More Insight

- Standard waveform library provides quick access to common signals (DC, half-sine, noise, sine, square, triangle, ramp, pulse, exponential)
- Comprehensive library of built-in signals provides fast, easy access to complex signals
- Free-hand, point and line-draw modes to create custom shapes
- Equation editor enables creation of waveforms with exact polynomials
- Advanced math functions provide additional flexibility for more complex signals
- Sequencing editor to build and arrange composite waveforms for design optimization
- Filtering and windowing functions allow smooth transitions between waveforms
- Fast Fourier Transform (FFT) capability enables viewing of signal frequency characteristics
- Complimentary Cumulative Distribution Function (CCDF) curves enables viewing of signal power characteristics



For Agilent 33200,
33500 and 81100
Series Function /
Arbitrary / Pulse
Waveform Generators

Create custom waveforms *faster*



Сравнение пакетов Waveform Builder

Features	Built-in Waveform Editor	Waveform Builder	Waveform Builder Pro
Price	Free	Free	\$750 US List
Basic Waveform Library	✓	✓	✓
33200, 33500 Series Connectivity	✓	✓	✓
Cut, Copy, Paste w/ Excel*	✓	✓	✓
Waveform Math	✓	✓	✓
Free Hand		✓	✓
Line Draw		✓	✓
Complex Waveform Library			✓
81100 Series Connectivity			✓
Equation Editor			✓
Point Draw**	✓		✓
FFT, CCDF, and Constellation Diagram			✓
Filters			✓
Windowing Functions			✓
Dual Channel Operation			✓

*Built-in Waveform Editor does not use Excel but can cut, copy and paste

**Limited functionality in Built-in Waveform Editor

Генераторы серий 33500А и 33500В Agilent

		Model	Bandwidth and Resolution	Interface	Price* CIP
33500B Series Trueform Technology		33509B	20 MHz Sine, 16 bit, 1-ch	LXI-C, USB, GPIB	\$1,653
		33510B	20 MHz Sine, 16 bit, 2-ch	LXI-C, USB, GPIB	\$2,530
		33511B	20 MHz Sine, 250 MSa/s ARB, 16 bit, 1-ch	LXI-C, USB, GPIB	\$1,955
		33512B	20 MHz Sine, 250 MSa/s ARB, 16 bit, 2-ch	LXI-C, USB, GPIB	\$2,956
		33519B	30 MHz Sine, 16 bit, 1-ch	LXI-C, USB, GPIB	\$1,854
		33520B	30 MHz Sine, 16 bit, 2-ch	LXI-C, USB, GPIB	\$2,830
33200 Series DDS Technology		33521B	30 MHz Sine, 250 MSa/s ARB, 16 bit, 1-ch	LXI-C, USB, GPIB	\$2,154
		33522B	30 MHz Sine, 250 MSa/s ARB, 16 bit, 2-ch	LXI-C, USB, GPIB	\$3,256
		33210A	10 MHz Sine, 50 MSa/s ARB (opt), 14 bit	LXI-C, USB, GPIB	\$1,279
		33220A	20 MHz Sine, 50 MSa/s ARB, 14 bit	LXI-C, USB, GPIB	\$2,252
		33250A	80 MHz Sine, 200 MSa/s ARB, 12 bit	GPIB, RS-232	\$4,797
		33502A	2-ch 50 Vpp Isolated Amplifier	LXI-C, USB	\$2,724
		33503A	BenchLink Waveform Builder Pro	Software	\$750

Генераторы сигналов произвольной формы: серия 33500B

33509B, 33510B, 33511B,

Стандартные формы
сигналов

- Sine, Square, Ramp, Triangle, Pulse, Noise, DC, Sinc, Exponential, PRBS and built-in arbitrary waveforms
- Modulation (AM, FM, PM, FSK, BPSK, PWM, Sum)
- Sweep (linear, log and list)
- Burst (gated and count)

Поточечное построение
сигналов произвольной формы

- 250 MSa/s arbs, разрешение 16 бит
- 1 MSa/канал – стандартная память, опциональная - 16 MSa
- On-screen Editor for arbs
- Waveform Builder Basic SW included, optional advanced editing Pro SW



Интерфейсы ввода-вывода

- LAN (LXI-C), USB и GPIB
- USB порт для работы с результатами

1B Trueform
Technology

Исключительное
удобство пользования

- Интуитивно понятная панель управления
- Полный доступ с мобильного устройства
- LXI web browser

Дисплей высокого
разрешения

- 4.3" WQVGA дисплей

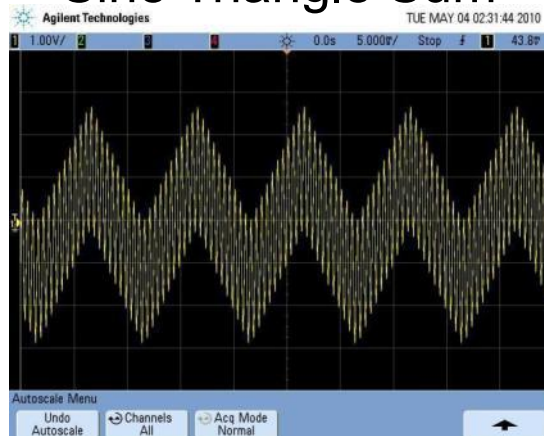
Model No.	Description	ARB
33509B	20 MHz, 1-channel	
33510B	20 MHz, 2-channel	
33511B	20 MHz, 1-channel	■
33512B	20 MHz, 2-channel	■
33519B	30 MHz, 1-channel	
33520B	30 MHz, 2-channel	
33521B	30 MHz, 1-channel	■
33522B	30 MHz, 2-channel	■



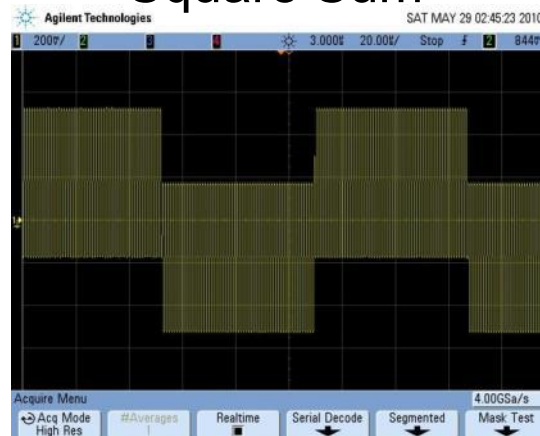
33500 Series Function / Arbitrary Waveform Generators

Примеры экрана

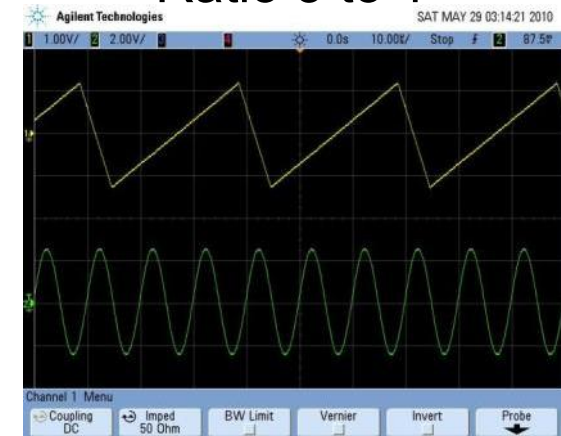
Sine Triangle Sum



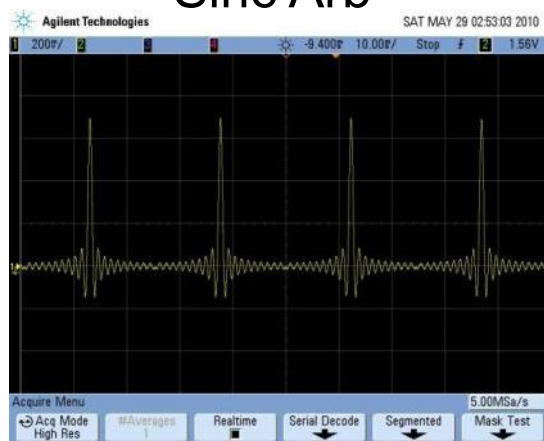
Square Sum



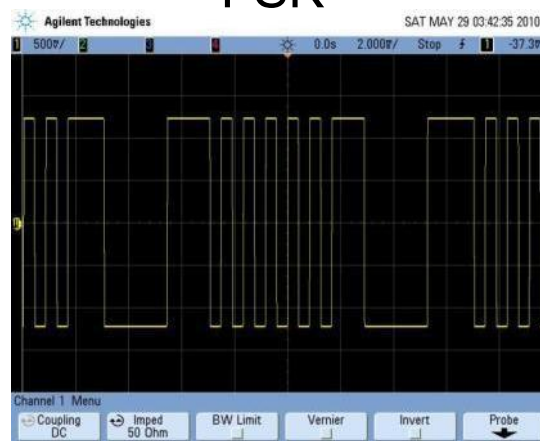
Ratio 3 to 1



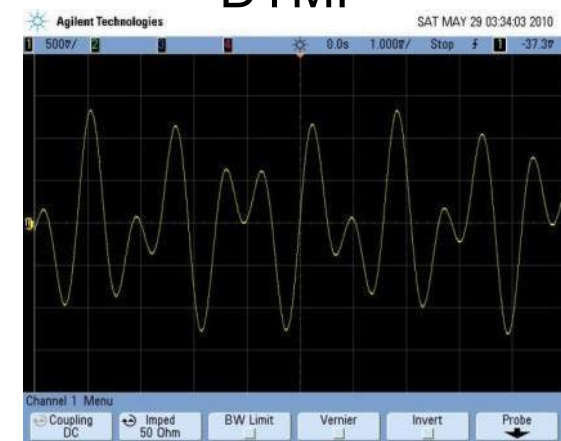
Sinc Arb



FSK



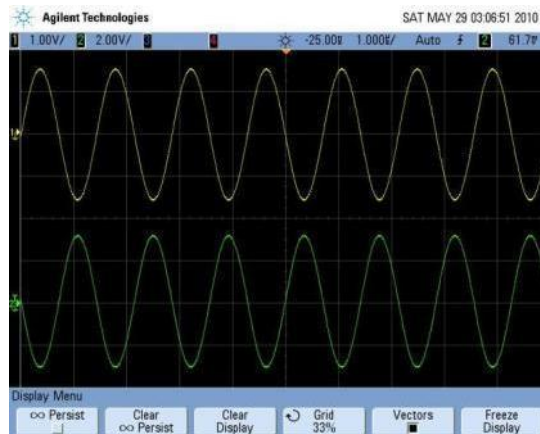
DTMF



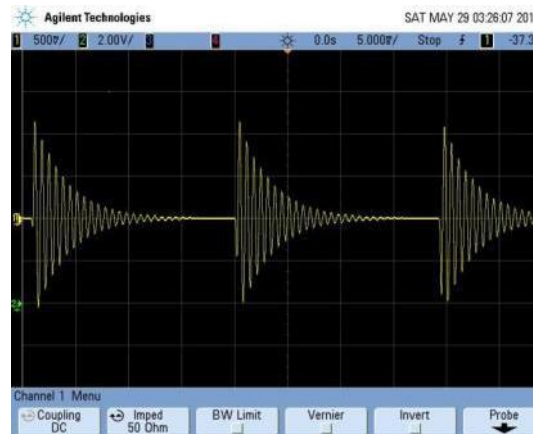
33500 Series Function / Arbitrary Waveform Generators

Примеры экрана (продолжение)

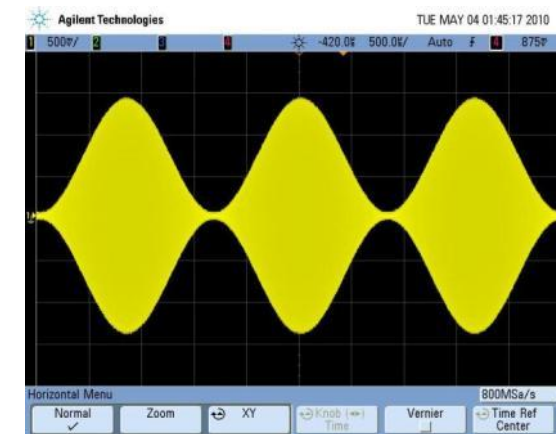
Differential Sine



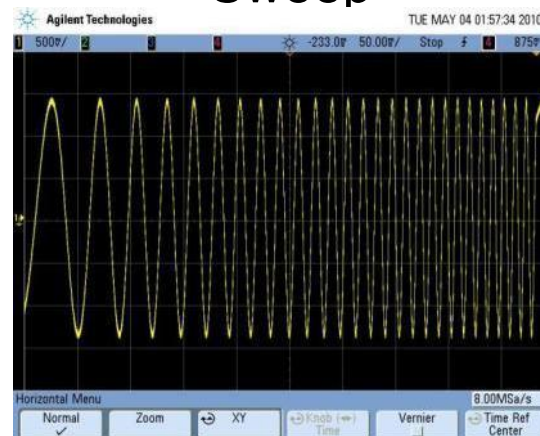
Decaying Sine



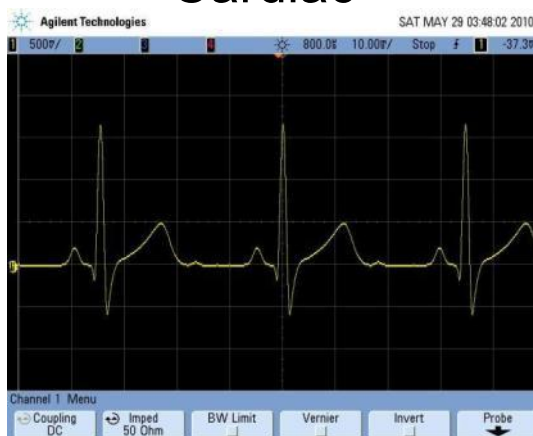
AM Modulation



Sweep



Cardiac



Product Positioning:

33210A FG/ARB vs. WaveGen functionality of the 2000/3000 Series Scope – Features

The WaveGen option on the 2000/3000 X-Series oscilloscopes targets the low-end budget solution for signal generation where applying a simple signal is just-enough. As customers require more performance and features in their function generators, they will require a discrete instrument and likely move in to the mid-performance segment of the market where the 33200 and 33500 Series Function / Arbitrary Waveform Generators target. The 33210A 10MHz Function / Arbitrary Waveform Generator is the lowest-end model of this segment. Below is the first of three side-by-side tables to compare the features and specifications.

Typical Customers	33210A Function / Arbitrary Waveform Generator	WaveGen Option InfiniiVision 2000/3000 X-Series Scopes
Typical Customers	Primarily R&D engineers and advanced education labs	Primarily entry education teaching labs and some basic R&D engineering tasks
Customer Needs Addressed	Advanced signal generation including arbitrary waveforms, modulation, sweeping, bursts, triggering, higher levels of accuracy/resolution, and higher levels of amplitude/offset	Ultra low-cost, basic signal generation

Product Positioning:

33210A FG/ARB vs. WaveGen functionality of the 2000/3000 Series Scope – Features

FYI: these represent different market segments

Features	33210A Function / Arbitrary Waveform Generator	WaveGen Option InfiniiVision 2000/3000 X-Series Scopes
Basic Waveforms	Sine, square, ramp, triangle, pulse , noise, DC	Sine, square, ramp, triangle, pulse, noise, DC
Arbitrary Waveforms	Yes, 50 MSa/s, 14 bits	3000 Series only, 100 MSa/s, 10 bits
Modulation (internal & external)	AM, FM, PWM (optional)	No
Frequency Sweep	Linear and logarithmic Sweep up and down	No
Burst Mode	Counted, infinite, and gated	No
External Trigger In	Yes	No
External frequency reference (synch to external clock)	Yes (optional)	No
Multi-instrument synchronization	Yes	No



Product Positioning:

33210A FG/ARB vs. WaveGen functionality of the 2000/3000 Series Scope – Specifications

FYI: these represent different market segments

Specifications	33210A Function / Arbitrary Waveform Generator	WaveGen Option InfiniiVision 2000/3000 X-Series Scopes
Sine, Square Bandwidth	10 MHz, both	20 MHz, 10 MHz
Pulse Parameters	1% to 99% duty cycle, variable edge times	Pulse/square same, 20% to 80% duty cycle, no variable edge time
Frequency accuracy	10 ppm, 90 days, 20 ppm, 1 year	130 ppm, <10 kHz, 50 ppm >10 kHz
Frequency resolution	1 μ Hz (internal), 1 mHz (user)	100 mHz
Amplitude ranges	10 Vpp into 50 Ohms	2.5 Vpp into 50 Ohms
Amplitude Flatness (sine)	0.1 dB	0.5 dB
Total Harmonic Distortion (THD)	0.04%	1%
DC Offset Range	+/- 5 V into 50 Ohms	+/-1.25 V into 50 Ohms

Низший уровень гармоник: Trueform vs DDS

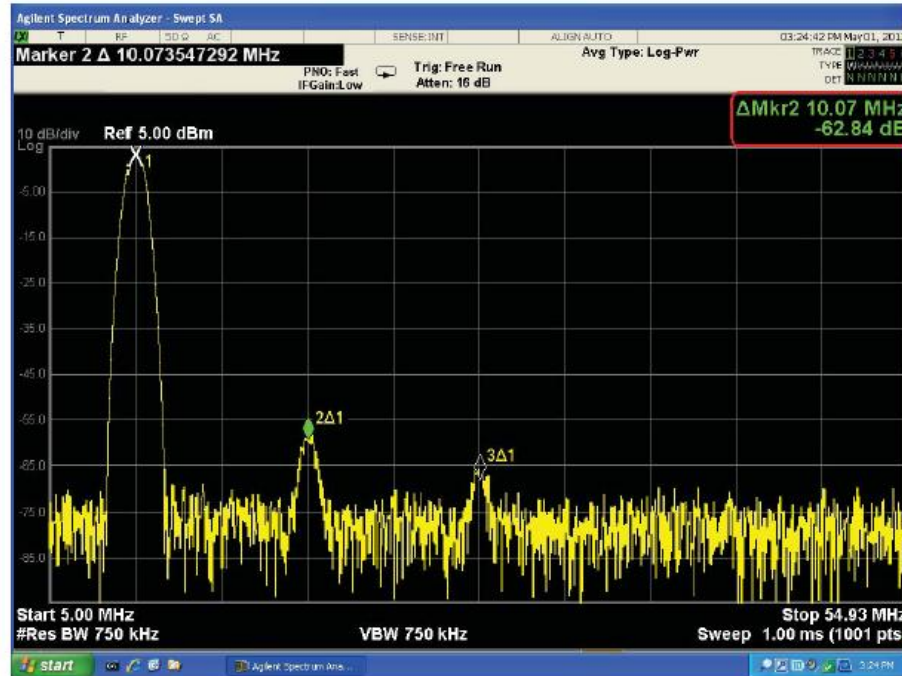


Figure1. Harmonics from Trueform technology

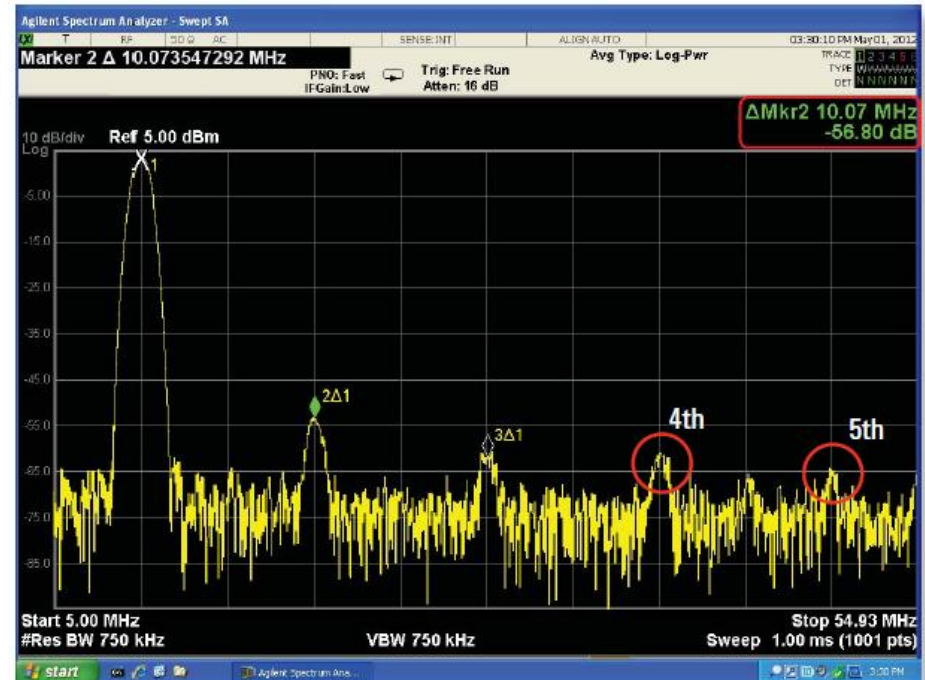


Figure2. Harmonics from DDS technology

Уровень джиттера: Trueform vs DDS

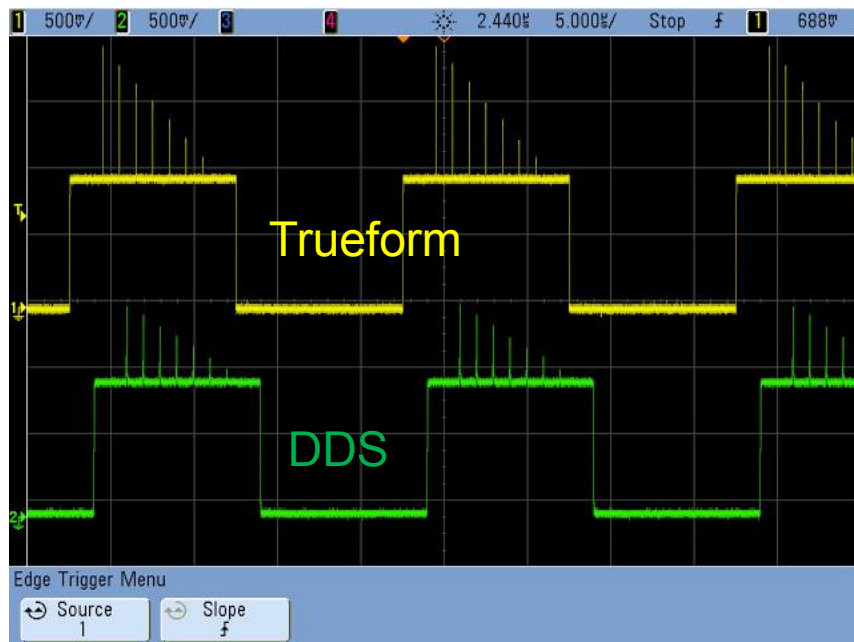
Trueform джиттер



DDS джиттер

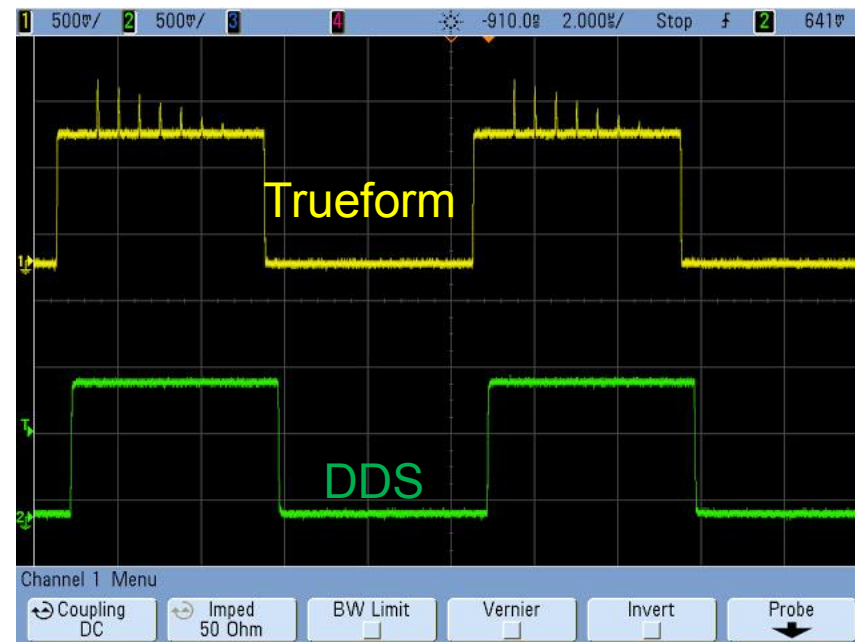


Технология: *Trueform* против DDS



Сигнал воспроизводимый с частотой 50KHz

DDS пропускает части формы сигнала



Сигнал, воспроизводимый с частотой 100KHz

33500B Series Function Generators / Arbitrary Waveform Generators More Resources

