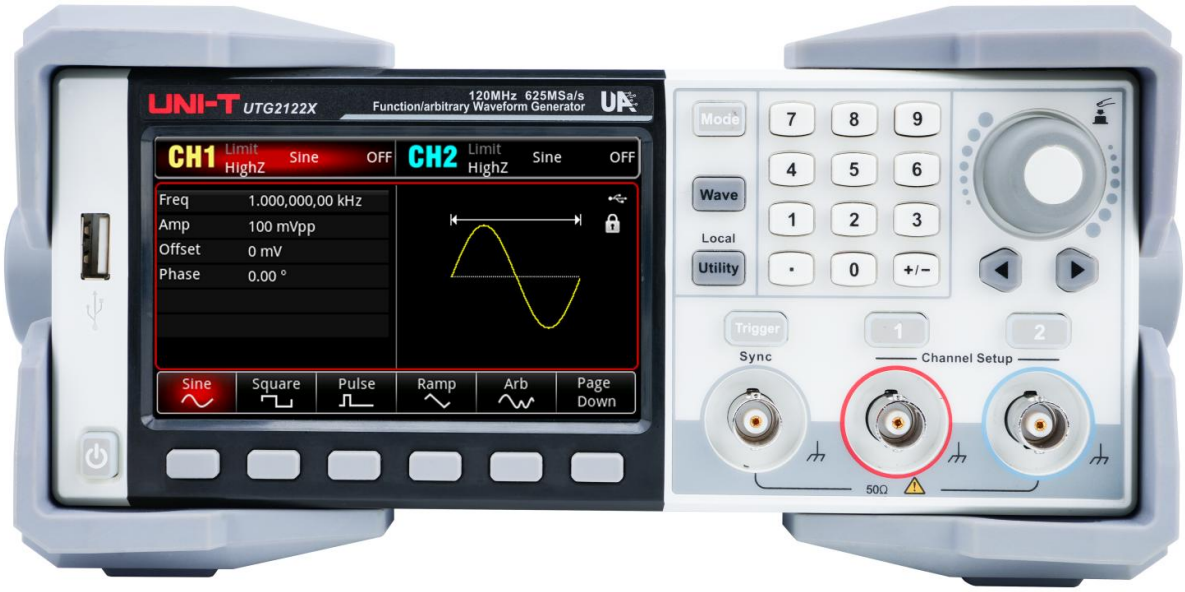
UNI-T®

Instruments.uni-trend.com



Data Sheet

UTG2000X Series Function/Arbitrary Waveform Generator

V 1.1

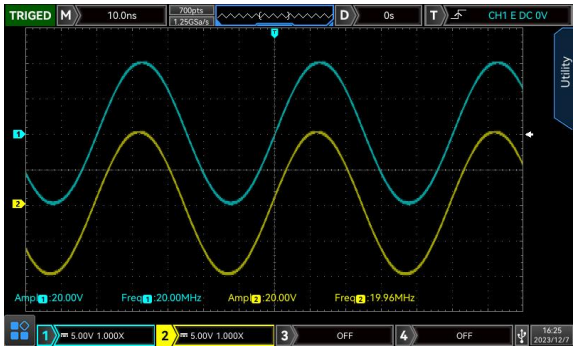
July 2024

Product Features

- Dual channel with a maximum frequency output of 120 MHz and a maximum output amplitude of 20 Vpp.
- 625 MSa/s sample rate and 16-bit vertical resolution
- Multiple analog and digital modulation function: AM, PM, FM, DSB-AM, ASK, PSK, BPSK, QPSK, FSK, 3FSK, 4FSK, QAM, OSK, PWM, and SUM
- Square wave with the maximum frequency of 50 MHz and low jitter
- Wide dynamic and high-precision pulse wave with adjustable edge time, which can achieve fine edge time adjustment and has extremely high adjustment resolution and range
- Excellent performance with low harmonic distortion
- Supports frequency sweep and burst output
- A low-jitter waveform can be generated point by point, with an arbitrary waveform length ranging from 8 points to 64 megapoints (Mpts)
- Supports channel copying, following, and stacking settings
- Can generate arbitrary waveform through arbitrary waveform editor on the upper computer
- 7-bit hard frequency counter
- Built-in 200 arbitrary waves
- Standard USB Host, USB Device, and LAN interface
- Support SCPI (programmable instrument standard commands)
- 4.3 inch TFT LCD capacitive touch display screen

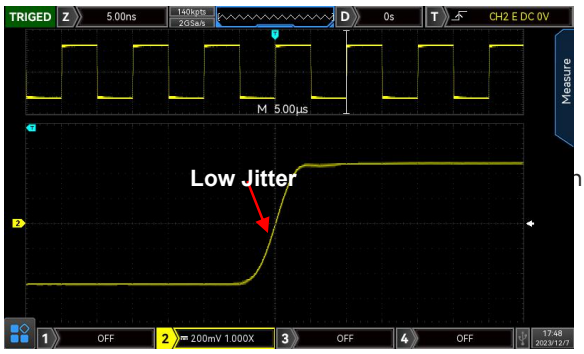
Design Features

Equivalent performance of double channel output



Large output under the high frequency: double channel with full amplitude output of 20 Vpp can be output under the frequency of 20 MHz.

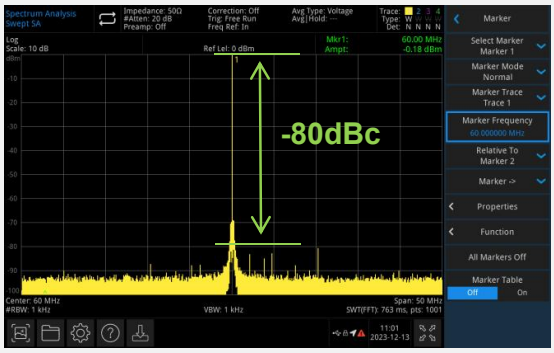
Low Jitter



Excellent digital sampling technology significantly reduces output waveform jitter.

Low Distortion Output

Outstanding harmonic distortion

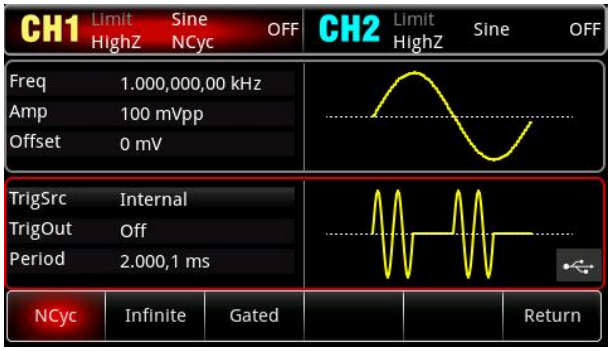


-80dBc spurious free dynamic range

High Signal to Noise Ratio

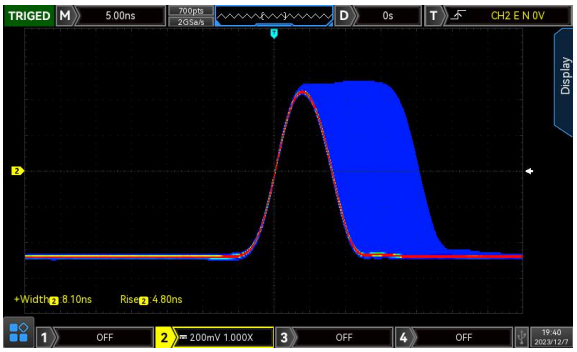
A small signal superimposed with a large DC results in a lower output noise and a higher SNR.

Burst



Three types of bursts: “N cycle,” “Infinite,” and “Gate.” Three trigger sources: “Internal,” “External,” and “Manual.”

Pulse Wave and Edge Time

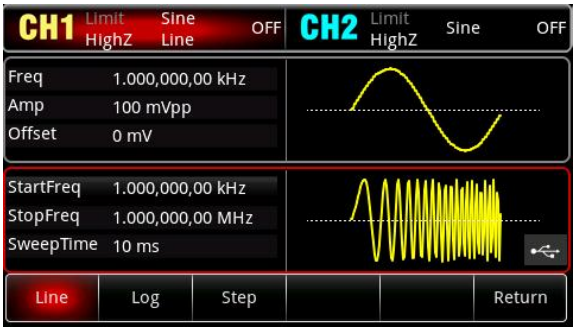


The new generation of wide dynamic, high-precision, edge-time adjustable pulse wave has a minimum pulse width of 8 ns. The pulse width can be fine adjusted and the minimum step is 100 ps. In addition, it can produce higher harmonic component, which has the feature of a dedicated pulse generator. The edge time can be independently set to a minimum of 5 ns.

Multiple Modulation Function

Modulation output (15 types): AM, FM, PM, DSB-AM, ASK, FSK, PSK, 3FSK, 4FSK, BPSK, QPSK, OSK, SUM, QAM and PWM.

Sweep Frequency

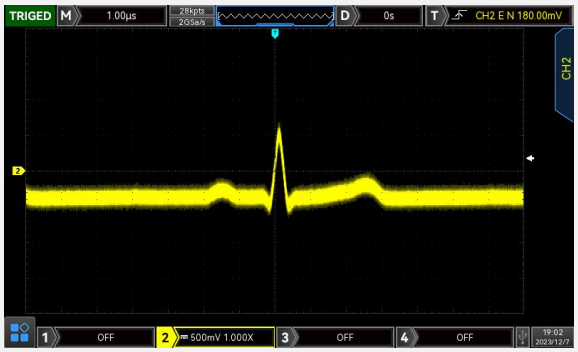


Three sweep frequency modes: “Line”, “Log” and “Step”.Three trigger sources: “Internal”, “External” and “Manual”.

Frequency Counter

The high precision hardware frequency counter can measure the frequency range of 100 mHz to 200 MHz.

Channel Merge

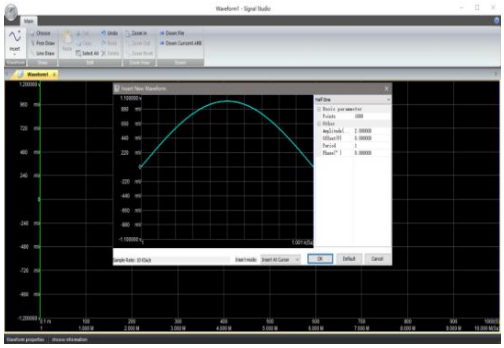


Channel merging can be realized with SUM or channel stacking functions, generating signals with adjustable signal-to-noise ratios and dual-tone multi-frequency signals. Up to four signals can be summed and coupled on two channels, and SUM enables the output of two-tone or multi-tone signals.

Channel Tracking

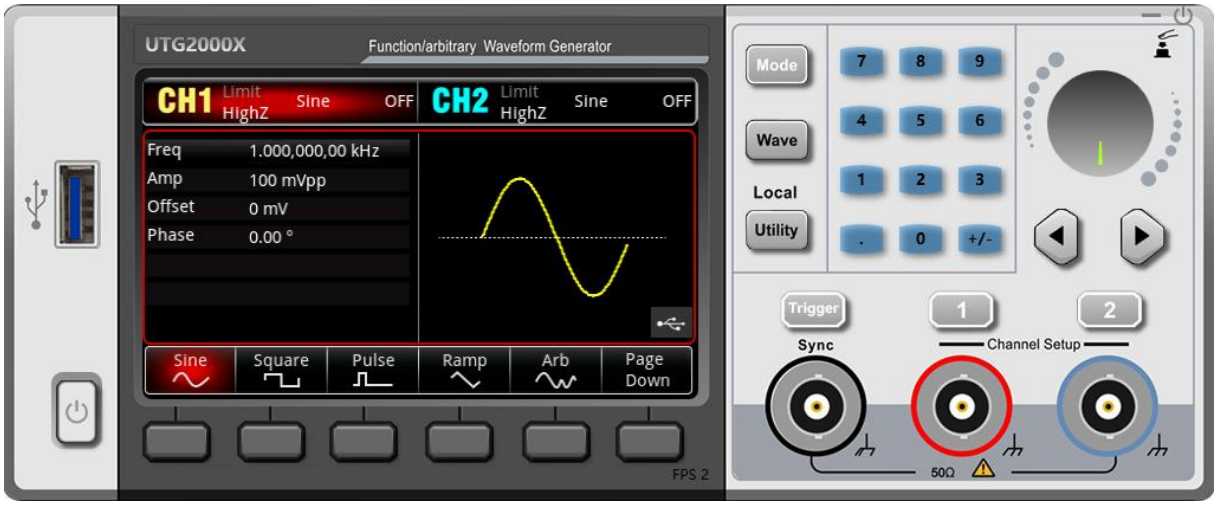
Channel tracking simplifies the operation of dual channels. The phase, amplitude and frequency of both channels can be controlled by a single parameter, making it easy to create deviation or tracking signals.

Arbitrary Waveform Editor



The arbitrary waveform editor offers diverse generation methods. Arbitrary waveforms can be created by inserting standard waveforms or drawing freely.

Remote Control



The instrument can connect to the computer via USB and LAN port and it supports remote control.
Users can use the control software for remote operation and control, enabling automatic testing and remote monitoring.

4. 3inch Capacitive Touch Screen

4.3-inch high-definition display with touch operation, making instrument control faster and more convenient.

Definition and Condition

- "Technical Index" provide a detailed description of the performance of the parameters which involved in the product warranty. Unless otherwise specified, these specifications are applicable to the temperature range from 18 °C to 28 °C.
- "Typical Value" refers to other product performance information which not covered in the product warranty. When performance exceeds the technical index, 80% of the units can exhibit 95% confidence in the temperature range of 18 °C to 28 °C. Typical performance does not include uncertainty of measurement.
- "Nominal Value" means the expected performance or describes the performance of the product that is useful in the application of the product but is not included in the scope of the product warranty.

  Under the following conditions, it can achieve its technical indicators:

  Within the calibration cycle and after being warmed up for at least 30 minutes. If the device is stored in an environment that is within the allowable storage temperature range but exceed the allowable operating temperature range, the instrument must be placed within the allowable operating temperature range for at least two hours

Basic Waveform Characteristics

All analog channel output related specifications is suitable for channel 1 and channel 2

Basic characteristics			
Model	UTG2062X	UTG2082X	UTG2122X
Channel	Dual channel		
Sampling rate	625 MSa/s (1.25 GSa/s, 2 x interpolation)		
Vertical resolution	16-bit		
Working modes	Continuous, Modulation, Frequency sweep, Burst, and Counter		
Wave	Sine, Square, Ramp, Pulse, Noise, DC, Arb, Harmonic, PRBS, Expression, and Double pulse		
Modulation	AM, FM, PM, DSB-AM, ASK, FSK, PSK, 3FSK, 4FSK, BPSK, QPSK, OSK, SUM, QAM, and PWM		
Frequency sweep	Lin, Log, and Step		
Burst	N-cycle, Gated, and Infinite		
Counter	100 mHz to 200 MHz, 7 digits		
LCD	4.3 inch TFT LCD capacitive touch display screen, WVGA (480×272)		

Frequency characteristic			
Sine wave	1 μHz to 60 MHz	1 μHz to 80 MHz	1 μHz to 120 MHz
Square wave	1 μHz to 30 MHz	1 μHz to 40 MHz	1 μHz to 50 MHz
pulse wave	1 μHz to 30 MHz	1 μHz to 40 MHz	1 μHz to 50 MHz
Ramp wave	1 μHz to 3 MHz	1 μHz to 4 MHz	1 μHz to 5 MHz
Arbitrary wave	1 μHz to 30 MHz	1 μHz to 40 MHz	1 μHz to 50 MHz
Harmonic	1 μHz to 30 MHz	1 μHz to 40 MHz	1 μHz to 50 MHz
Expression	1 μHz to 15 MHz	1 μHz to 20 MHz	1 μHz to 25 MHz
PRBS	1 μbps to 30 Mbps	1 μbps to 40 Mbps	1 μbps to 50 Mbps
Gauss noise	1 MHz to 60 MHz	1 MHz to 80 MHz	1 MHz to 120 MHz
Resolution	1 μHz		
Reference frequency	Frequency: 10.0000 MHz		
	Initial accuracy: ±0.5 ppm, 25°C		
	Temperature stability: ±0.5 ppm, 0°C to 40°C		
	Annual aging rate: ±1 ppm, First year aging rate		
Sine wave			
Frequency	1 μHz to 60 MHz	1 μHz to 80 MHz	1 μHz to 120 MHz
Harmonic distortion	Typical value (0 dBm)	DC to 1 MHz: -70 dBc	
		1 MHz to 10 MHz: -65 dBc	
		10 MHz to 40 MHz: -60 dBc	
		40 MHz to 80 MHz: -55 dBc	
		80 MHz to 120 MHz: -50 dBc	
THD	< 0.07% (DC to 20 kHz, 1 Vpp)		
Spurious signal (anharmonic)	Typical value (0 dBm)	≤10 MHz ,< -70 dBc	
		>10 MHz ,<-70 dBc+6 dB/octave	
Phase noise(typical)	10 MHz: ≤-125 dBc/Hz (typical, 0 dBm, 10 kHz deviation)		
Square wave			
Frequency	1 μHz to 30 MHz	1 μHz to 40 MHz	1 μHz to 50 MHz
Rise/fall time (1 Vpp，50 Ω)	<7 ns (typical, 1 kHz)	<6 ns (typical, 1 kHz)	<5 ns (typical, 1 kHz)
Overshoot (100kHz，1 Vpp)	< 2% (typical, 50 Ω)		
Duty ratio	0.001% to 99.999% (limited by current frequency)		
Symmetry (duty ratio=50%)	1% of period + 4 ns		
Jitter(RMS) (1 Vpp，	Typical (1 MHz,	≤ 5 MHz:2 ppm + 200 ps	

50 Ω)	1 Vpp, 50 Ω)	> 5 MHz:200 ps	
Ramp wave			
Frequency	1 μHz to 3 MHz	1 μHz to 4 MHz	1 μHz to 5 MHz
Non-linearity	< 1% of peak output (typical value, 1 kHz, 1 Vpp, symmetry 100%)		
Symmetry	0.0% to 100.0%		
Pulse wave			
Frequency	1 μHz to 30 MHz	1 μHz to 40 MHz	1 μHz to 50 MHz
Minimum pulse width	8 ns		
Variable edge	7 ns to 10 s	6 ns to 10 s	5 ns to 10 s
Duty ratio	0.001% to 99.999% (limited by current frequency)		
Overshoot	< 2% (typical, 1 Vpp 50 Ω)		
Jitter	150 ps		
Arbitrary wave			
Frequency (DDS)	1 μHz to 30 MHz	1 μHz to 40 MHz	1 μHz to 50 MHz
Wave length	DDS	8 kpts (Regular)	
	Point by point	8 pts to 32 Mpts (Up to 64 Mpts for single channel output)	
Vertical resolution	16-bit (symbol included)		
Sampling rage	DDS	625 MSa/s (DDS)	
	Point by point	1 μSa/s to 312.5 MSa/s	
Minimum rise/fall time	<5 ns (typical, 1 Vpp, 50 Ω)		
Jitter (playback mode)	150 ps		
Nonvolatile storage	200 waves		
PRBS			
Bit rate	1 μbps to 30 Mbps	1 μbps to 40 Mbps	1 μbps to 50 Mbps
Edge time	7 ns to 1,000 s	6 ns to 1,000 s	5 ns to 1,000 s
Symbol	PN3, PN5, PN7, PN9, PN11, PN13, PN15, PN17, PN19, PN21, PN23, PN25, PN27, PN29, PN31		
Expression properties			
Frequency	1 μHz to 15 MHz	1 μHz to 20 MHz	1 μHz to 25 MHz
Function	Sin, cos, tan, sinc, abs, ln, sqrt, acos, asin, atan, sinh, tanh, ceil, exp, fabs, floor,lg,cosh		
Operation	+ , - , * , / , ^		
Variable value	°, rad		

Harmonic			
Frequency	1 μHz to 30 MHz	1 μHz to 40 MHz	1 μHz to 50 MHz
Harmonic order	2 to 16		
Type	Odd, Even, All, User Defined		
Amplitude	1 mV to 10 Vpp (50 Ω)		
	Set the amplitude based on the selected harmonic sequence number		
Phase	-360° to 360°		
	Set the phase based on the selected harmonic sequence number		
Double Pulse			
Trigger Source	Internal, external, manual		
Delay	0 to 100 s		
Total number	2 to 30		
Minimum pulse width	20 ns		
Variable edge	5 ns to 500 s		
Pulse gap	20 ns to 1 ks		

Output Characteristic

Output		
Amplitude (50 Ω)	≤20 MHz:1 mVpp to 10 Vpp	
	≤60 MHz:1 mVpp to 5 Vpp	
	≤120 MHz:1 mVpp to 2 Vpp	
Amplitude (High resistance)	≤20 MHz:2 mVpp to 20 Vpp	
	≤60 MHz:2 mVpp to 10 Vpp	
	≤120 MHz:2 mVpp to 4 Vpp	
Accuracy	Typical value(1kHz, sine wave, 0V, deviation, >10 mVpp)	± (1% of set value+1 mVpp)
Amplitude flatness	Typical value (1kHz, sine wave, 1 Vpp)	≤60 MHz: ±0.2 dB
		≤80 MHz: ±0.4 dB
		≤120 MHz: ±0.6 dB
DC offset		
Range(peak AC+DC)	±5 V (50 Ω)	
	±10 V (High resistance)	
Accuracy of offset	Offset set value ±1% ± amplitude set value 0.5% ±2 mV	

Waveform output	
Impedance	50 Ω typical value
Protection	Overvoltage protection, overload automatically disabling waveform output

Modulation Types

Model	UTG2062X	UTG2082X	UTG2122X
AM			
Carrier wave	Sine wave, square wave, ramp wave, arbitrary wave, and pulse wave		
Source	Internal/External		
Modulation wave	Sine wave, square wave, ramp wave, noise, and arbitrary wave		
Modulation depth	0% to 120%		
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)		
FM			
Carrier wave	Sine wave, square wave, ramp wave, arbitrary wave, and pulse wave		
Source	Internal/External		
Modulation wave	Sine wave, square wave, ramp wave, noise, and arbitrary wave		
Frequency deviation	DC to 30 MHz	DC to 40 MHz	DC to 60 MHz
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)		
PM			
Carrier wave	Sine wave, square wave, ramp wave, and arbitrary wave		
Source	Internal/External		
Modulation wave	Sine wave, square wave, ramp wave, noise, and arbitrary wave		
Phase deviation	0 to 360°		
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)		
DSB-AM			
Carrier wave	Sine wave, square wave, ramp wave, arbitrary wave, and pulse wave		
Source	Internal/External		
Modulation wave	Sine wave, square wave, ramp wave, noise, and arbitrary wave		
Modulation depth	0% to 100%		
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)		
ASK			
Carrier wave	Sine wave, square wave, ramp wave, arbitrary wave, and pulse wave		
Source	Internal/external		
Modulation wave	Square wave (Duty ratio 50%)		

Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)
FSK	
Carrier wave	Sine wave, square wave, ramp wave, arbitrary wave, and pulse wave
Source	Internal/external
Modulation wave	Square wave (Duty ratio 50%)
Hopping frequency	Carrier Frequency
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)
PSK	
Carrier wave	Sine wave, square wave, ramp wave, and arbitrary wave
Source	Internal/external
Modulation wave	Square wave (Duty ratio 50%)
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)
Phase	-360° to 360°
3FSK	
Carrier wave	Sine wave, square wave, ramp wave, arbitrary wave, and pulse wave
Source	Internal
Modulation wave	Square wave (Duty ratio 50%)
Hopping frequency	Carrier Frequency
Modulation frequency	2 mHz to 1 MHz(The modulation source is internal)
4FSK	
Carrier wave	Sine wave, square wave, ramp wave, arbitrary wave, and pulse wave
Source	Internal
Modulation wave	Square wave (Duty ratio 50%)
Hopping frequency	Carrier Frequency
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)
BPSK	
Carrier wave	Sine wave, square wave, ramp wave, and arbitrary wave
Source	Internal
Symbol	PN3, PN5, PN7, PN9, PN11, PN13, PN15, PN17, PN21, PN23, PN25, PN27, PN29, and PN31
Symbol bit rate	2 mbps to 1 Mbps (The modulation source is internal)
Phase	-360° to 360°
QPSK	
Carrier wave	Sine wave, square wave, ramp wave, and arbitrary wave
Source	Internal
Symbol	PN3, PN5, PN7, PN9, PN11, PN13, PN15, PN17, PN21, PN23, PN25,

	PN27, PN29, and PN31
Symbol bit rate	2 mbps to 1 Mbps (The modulation source is internal)
Phase	-360° to 360°
OSK	
Carrier wave	Sine wave
Source	Internal/external
Oscillation time	5 ns to 250 s
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)
SUM	
Carrier wave	Sine wave, square wave, ramp wave, arbitrary wave, pulse wave, harmonics, and noise
Source	Internal/External
Modulation wave	Sine wave, square wave, ramp wave, noise, and arbitrary wave
Modulation depth	0% to 100%
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)
QAM	
Carrier wave	Sine wave
Constellation mapping	QAM4, QAM8, QAM16, QAM32, QAM64, QAM128, and QAM256
Symbol	PN3, PN5, PN7, PN9, PN11, PN13, PN15, PN17, PN21, PN23, PN25, PN27, PN29, and PN31
Symbol bit rate	2 mbps to 1 Mbps
PWM	
Carrier wave	Pulse
Source	Internal/external
Modulation wave	Sine wave, square wave, ramp wave, noise, and arbitrary wave
PWM range	0% to 49.99%
Modulation frequency	2 mHz to 1 MHz (The modulation source is internal)

Sweep

Frequency sweep	
Carrier wave	Sine wave, square wave, ramp wave, arbitrary wave, and pulse wave
Type	Linear, Logarithmic, and Stepwise
Trigger Source	Internal, external, and manual
Trigger Edge	Rising edge, falling edge
Trigger Output	ON, OFF

Frequency sweep time	1 ms to 500 s ± 0.1% (Lin, Log)
Residence time	1 ms to 500 s ± 0.1% (step)
Step number	2 to 2,048 step

Burst

Burst	
Waveform	Sine wave, square wave, ramp wave, pulse, and arbitrary wave
Mode of pulse train	N cycle, infinite, and gated
Initial and stop phase	-360° to 360°
Source	Manual, external, and internal
Trigger edge	Rising edge/falling edge
Trigger Output	ON, OFF
Internal cycle	1 us to 500 s ± 0.1%
Recurring number	1 to 50,000
Polarity	Positive and negative (TTL level input)

Auxiliary functions

Channel settings	
Channel output	ON, OFF
Channel reverse	ON, OFF
Synchronous output	CH1, CH2, and OFF
Load	50 Ω, 75 Ω, HighZ, and Custom (1 Ω to 999999 Ω)
Amplitude limitation	ON, OFF
Upper limit of amplitude	-9.998 V to 10 V (HighZ)
Lower limit of amplitude	-10 V to 9.998 V (HighZ)
Channel replication	
Channel 1 replication	CH1→CH2
Channel 2 replication	CH2→CH1
Channel Follow	
Follow type	Parameter following, channel tracking
Parameter follow	Frequency following, amplitude following, and phase following
Follow type	Deviation, Ratio
Channel stacking	
Channel 1 overlay	ON, OFF

Channel 2 overlay	ON, OFF
System settings	
Language	English, Chinese, and Deutsch
Phase synchronization	Independent, synchronized
Voice	ON, OFF
Number separator	Comma, space, and none
Backlight	10%, 30%, 50%, 70%, 90%, and 100%
Screen saver	Off, 5 minutes, 15 minutes, 30 minutes, and 1 hour
Frequency meter	
Measurement frequency range	100 mHz to 200 MHz
Input Level Range	TTL compatibility
Measurement accuracy	7 digits

Interface and Display

Interface	
Standard configuration	USB Host, USB Device, and LAN
Synchronous signal output	
Output level	TTL compatible
Frequency	1 μHz to 10 MHz
Output Impedance	50 Ω (Typical)
Coupling method	DC
External modulation input	
Input frequency	<50 KHz
Depth	±5 Vpk=100%
Impedance	5 kΩ (Typical)
External reference input	
Input frequency	10 MHz ± 50Hz
Input level	TTL compatible
Impedance	10 kΩ (Typical value, DC coupling)
Lock time	<1 s
Internal reference output	
Input frequency	10 MHz
Input level	TTL compatible
Impedance	50 Ω (Typical value, DC coupling)

Trigger Input	
Input level	TTL compatible
Slope	Rising or falling
Pulse width	＞100 ns
Impedance	10 kΩ (Typical value, DC coupling)
Response time	<1 us (Typical value)
Trigger Output	
Input level	TTL compatible
Pulse width	＞400 ns (Typical value)
Impedance	50 Ω (Typical value)
Display screen	
Display type	4.3 inches TFT LCD Capacitive Touch Screen
Display resolution	WVGA (480×272)

General Technical Specifications

Specifications	
Supply voltage	100 to 240 VAC (Fluctuations: ±10%), 50 Hz/60 Hz; 100 to 120 VAC (Fluctuations: ±10%), 400 Hz
Power consumption	＜50 W
Fuse	2.5 A, Class T, 250 V
Environment	
Temperature range	Operation: +10 °C to +40 °C
	Non operational: -20 °C to +60 °C
Cooling method	Natural cooling
Humidity range	+35 °C Below: ≤90% relative humidity
	+35 °C to +40 °C: ≤60% relative humidity
Altitude	Operating below 2, 000 m
	Non-operating below 15, 000 m
Class of pollution	2
Operating environment	Indoor
Mechanical specifications	
Dimensions	215mm×103mm×316mm (Width x Height x Length)
Net weight	2.5 kg
Calibration cycle	The recommended calibration cycle is one year
Regulatory standards	

EMC	Compliance with EMC directives (2014/30/EU), Conform to or better than IEC 61326-1:2021/EN61326-1:2021, IEC 61326-2-1:2021/EN61326-2-1:2021	
Conductive disturbance	CISPR 11/EN 55011	CLASS B group 1, 150 kHz-30 MHz
Radiation disturbance	CISPR 11/EN 55011	CLASS B group 1, 30 MHz-1 GHz
Electrostatic discharge (ESD)	IEC 61000-4-2/EN 61000-4-2	4.0 kV (Contact), 8.0 kV (air)
Radio frequency electromagnetic field immunity	IEC 61000-4-3/EN 61000-4-3	0 V/m (80 MHz to 1 GHz); 3 V/m (1.4 GHz to 2 GHz); 1 V/m (2.0 GHz to 2.7 GHz)
Electrical fast transient burst (EFT)	IEC 61000-4-4/EN 61000-4-4	2 kV (AC input port)
Surge	IEC 61000-4-5/EN 61000-4-5	1 kV (Live line to zero line) 2 kV (Fire/zero line to ground)
Immunity to RF continuous conduction	IEC 61000-4-6/EN 61000-4-6	3 V, 0.15-80 MHz
Voltage dips and short interruptions	IEC 61000-4-11/EN 61000-4-11	Voltage dip: 0% UT during 1 cycle; 40% UT during 10/12 cycles; 70% UT during 25/30 cycles Short Interruption:0% UT during 250/300 cycles
Safety regulations		
	EN 61010-1:2010+A1:2019 EN IEC61010-2-030:2021+A11:2021 BS EN61010-1:2010+A1:2019 BS EN IEC61010-2-030:2021+A11:2021 UL 61010-1:2012 Ed.3+ R:19 Jul2019 UL 61010-2-030:2018 Ed.2 CSA C22.2#61010-1:2012 Ed.3+U1;U2;A1 CSA C22.2#61010-2-030:2018 Ed.2	

Ordering Information

	Description	Order No.
Models	Maximum output frequency 60 MHz	UTG2062X
	Maximum output frequency 80 MHz	UTG2082X
	Maximum output frequency 120 MHz	UTG2122X
Standard accessories	Power cord x 1	
	USB cable x 1	UT-D14
	BNC-BNC x 1	UT-L45
	BNC--red and black alligator clip cable x1	UT-L02A
Recommended options	10 W Power amplifier option	UT-M14

Remarks: All mainframes, accessories, and optional items can be ordered from the local UNI-T distributor.

Limited Warranty and Liability

Uni-T guarantees that the Instrument product is free from any defect in material and workmanship within three years from the purchase date. This warranty does not apply to damages caused by accident, negligence, misuse, modification, contamination or improper handling. If you need warranty service within the warranty period, please contact your seller directly. Uni-T will not be responsible for any special, indirect, incidental or subsequent damage or loss caused by using this device. For the probes and accessories, the warranty period is one year. Visit instrument.uni-trend.com for full warranty information.

Register your product to confirm your ownership. You will also get product notifications, update alerts, exclusive offers and all the latest information you need to know.

UNI-T is the licensed trademark of UNI-TREND TECHNONOLGY CO., Ltd. The product information in this document subject to update without notice. For more information on UNI-T Test & Measure Instrument products, applications or service, please contact UNI-T instrument for support, the support center is available on www.uni-trend.com ->instruments.uni-trend.com https://instruments.uni-trend.com/ContactForm/