▼Frequency and Phase

Frequency setting ranges

Oscillation mode / Waveform	Continuous, modulation, and sweep (continuous, single)	Sweep (gated) and burst
Sine	0.01 μHz to 30 MHz	0.01 μHz to 10 MHz
Square	0.01 μHz to 20 MHz	0.01 μHz to 10 MHz
Pulse	0.01 μHz to 20 MHz	0.01 μHz to 10 MHz
Ramp	0.01 μHz to 5 MHz	
Noise	The equivalent bandwidth is fixed to 26 MHz	
DC	Frequency setting invalid	
Arbitrary	0.01 μHz to 5 MHz	

Frequency setting resolution	0.01 μHz
Frequency accuracy *	± (3 ppm of setting + 2 pHz), aging rate* : ±1 ppm/year
Phase setting range	−1800.000° to +1800.000°

▼Output Characteristics

Amplitude	Setting range	0 Vp-p to 20 Vp-p/open, 0 Vp-p to 10 Vp-p/50 Ω AC + DC ≤ ± 10 V/open
	Setting resolution	999.9 mVp-p or less : 4-digit/0.1 mVp-p 1 Vp-p or greater : 5-digit/1 mVp-p
	Accuracy *	± (0.8% of amplitude setting [Vp-p] + 2 mVp-p)/open (1 kHz sine wave, amplitude setting : 20 mVp-p/open or greater)
	Setting unit	Vp-p, Vpk, Vrms, dBV, and dBm
	Resolution of waveform	16 bit (8 mVp-p/open or greater)
DC offset	Setting range	±10 V/open, ±5 V/50 Ω
	Setting resolution	±499.9 mV or less : 4-digit/0.1 mV, ±0.5 V or greater : 5-digit/1 mV
	Accuracy *	± (| 1% of DC offset setting [V] | + 5 mV + 0.5% of amplitude setting [Vp-p])/open (when outputting sine waves of 10 MHz or less)
Output impedance		50 Ω unbalanced
Output voltage of Synchronous/sub output		Sync signals TTL level, internal modulation signal −3 V to +3 V/open, sweep X drive 0 V to +3 V/open

▼Signal Characteristics

Sine	Amplitude frequency characteristics*	Up to 100 kHz : ±0.1 dB 100 kHz to 5 MHz : ±0.15 dB 5 MHz to 20 MHz : ±0.3 dB 20 MHz to 30 MHz : ±0.5 dB (± 0.8 dB at 2.8 Vp-p/50 Ω or higher) (50 mVp-p to 10 Vp-p/50Ω, reference frequency 1 kHz)		
	Total harmonic distortion*	20 Hz to 20 kHz : 0.04% or less (0.25 Vp-p to 10 Vp-p/50 Ω)		
	Harmonic spurious*		0.5 Vp-p to 2 Vp-p/50 Ω	2 Vp-p to 10 Vp-p/50 Ω
		Up to 1 MHz	−60 dBc or less	−55 dBc or less
		1 MHz to 10 MHz	−50 dBc or less	−43 dBc or less
		10 MHz to 30 MHz	−40 dBc or less	−30 dBc or less
	Non-harmonic spurious*	Up to 1 MHz : −65 dBc or less*, −70 dBc or less (typ.) 1 MHz to 3 MHz : −65 dBc or less* (0.5 Vp-p to 10 Vp-p/50 Ω) 3 MHz to 30 MHz : −65 dBc+6 dB/oct or less*		
Square	Duty variable	Variable range : Normal or extended (selectable) Setting range : Normal range 0.0100% to 99.9900% Upper limit (%) : 100 - frequency (Hz)/400,000 Lower limit (%) : frequency (Hz)/400,000 Extended range 0.0000% to 100.0000%		
	Rising/falling time*	15.5 ns or less (typ.), 17 ns or less *		
	Overshoot	5% or less typ.		
	Jitter	Normal variable range : 300 ps rms or less typ. Extended variable range : 2.5 ns rms or less typ.		
Pulse	Pulse width	Duty setting range : 0.0170% to 99.9830% Time setting range : 24.00 ns to 99.9830 Ms (resolution 0.01% of ftequency/0.01 ns)		
	Rising/falling time	Setting range : 15.0 ns to 62.5 Ms (resolution 3-digit/0.1 ns) Rising/falling time independently set, The minimum setting value is 0.01% of period or 15 ns, whichever is larger.		
	Overshoot	5% or less typ.		
	Jitter	500 ps rms or less typ. (10 kHz or more) 2.5 ns rms or less typ. (less than 10 kHz)		
Ramp		Symmetry setting range : 0.00% to 100.00%		
Arbitrary waveform	Waveform length	4 K to 512 K words (2^n, n=12 to 19) or the number of control points is 2 to 10,000 (Control points are linearly interpolated.)		
	Total of waveform saving capacity	Up to 128 waves or 4 M words (combined total for channels 1 and 2) Saved in the nonvolatile memory		
	Amplitude resolution	16 bit		
	Sampling rate	120 MS/s		

▼Modulation

Modulation type		FM, FSK, PM, PSK, AM, DC offset modulation, PWM
Internal modulation	Modulation waveform	Other than FSK, PSK : Sine, square (duty of 50%), triangle (symmetry 50%), rising ramp, falling ramp, noise, arbitrary waveforms FSK, PSK: Square (duty of 50%)
	Modulation frequency	Other than FSK, PSK, DC offset modulation : 0.1 mHz to 1 MHz (8-digit/0.1 mHz resolution) FSK, PSK : 0.1 mHz to 3 MHz (8-digit/0.1 mHz resolution) DC offset modulation : 0.1 mHz to 100 kHz (8-digit/0.1 mHz resolution)
External modulation	Input voltage range	±1 V full scale (other than FSK and PSK)
	Input impedance	10 kΩ unbalanced (other than FSK and PSK)
	Input frequency	DC to 40 kHz/−3 dB (other than FSK and PSK), DC to 3 MHz (FSK, PSK)

▼Sweep

Sweep type	Frequency, phase, amplitude, DC offset, and duty
Sweep function	One-way (ramp waveform shape)/shuttle (triangle waveform shape) selectable Linear/log (frequency sweep only) selectable
Sweep range setting	Start and stop values or the center and span values are specified.
Sweep time setting range	0.1 ms to 10,000 s (4-digit/0.1 ms resolution)
Sweep mode	Continuous/single-shot/gated single-shot selectable Oscillation only occurs during sweep execution in the gated single-shot mode.
Trigger source	Internal/external selectable
Internal trigger oscillator	Period setting range : 100.0 μs to 10,000 s (5-digit/0.1 μs resolution)
Stop level setting	Specifying signal level while oscillation is stopped during gated single shot sweep Setting range : −100.00% to +100.00% of amplitude full scale or off
Sweep input/output	Sweep sync/marker output, sweep X drive output, sweep external control input, sweep external trigger input

▼Burst/Trigger/Gate Operation

Burst mode	Auto burst, trigger burst, gate, and triggered gate modes (The gate is turned on/off at each trigger in the triggered gate mode.)
Number of mark/space waves	0.5 cycles to 999,999.5 cycles, in 0.5-cycle unit
Oscillation stop unit in the gate mode	1 cycle or 0.5 cycles selectable
Phase setting range	−1800.000° to +1800.000°
Stop level	Specifiying signal level while oscillation is stopped Setting range : −100.00% to +100.00% Oscillation stops at the set oscillation start/stop phase when the stop level is set to off.
Trigger source	Internal or external selectable, manual trigger allowed
Internal trigger oscillator	1.0 μs to 1,000 s (5-digit/0.1 μs resolution)
Trigger delay	0.00 μs to 100.00 s (8-digit/0.01 μs resolution) Except for latent delay. Valid in the trigger burst mode only.
External trigger input	TTL level, input impedance 10 kΩ (pulled up to +3.3 V), unbalanced
Manual trigger	Panel key operation, trigger delay allowed

▼2-channel Ganged Operation(WF1948 only)

Channel mode	Two channels independent, two phases (same frequency), constant frequency difference, constant frequency ratio, and differential output (same frequency, amplitude, DC offset, reversed waveform)
Same value setting, same operation	Set two channels at the same time.
Frequency difference setting range	0.00 μHz to less than 30 MHz (0.01 μHz resolution) CH-2 frequency - CH-1frequency
Frequency ratio N : M setting range	1 to 9,999,999 (for each of N and M) N : M= CH-2 frequency : CH-1 frequency

▼Other Functions

External 10 MHz frequency reference input	Input voltage : 0.5 Vp-p to 5 Vp-p, Sine or square
Frequency reference output	Output voltage : 1 Vp-p/50 Ω, square, 10 MHz (for Synchronization of multiple units)
External addition input	Gain : ×0.4, ×2, ×10 or off, selectable Input voltage/frequency : −1 V to +1 V, DC to 10 MHz (−3 dB) Input impedance : 10 kΩ unbalanced
Synchronous operation of multiple units	Up to 6 units can be connected in the form of master/slave, using the frequency reference output and external 10 MHz frequency reference input
User defined unit	Sets and displays the value in any unit, according to the specified conversion expression. Setting target : Frequency, period, amplitude, DC offset, phase, and duty
Setting memory	10 settings can be memorized (saved in the nonvolatile memory).
Interface	GPIB, USBTMC (SCPI-1999, IEEE-488.2)
Phase synchronization	Function to restart from the phase where the output waveforms for all the channels are set, automatic execution at channel mode switching

▼Generals

Display	3.5 inch TFT color LCD
Input/output ground	The signal grounds for waveform output, sync/sub output and external modulation/addition input are insulated from the housing. The signal ground for external 10 MHz frequency reference input is insulated from the housing.
Power requirements	AC100 V to 230 V ±10% (250 V max.) 50 Hz/60 Hz ±2 Hz
Dimensions(mm)	216(W)×132.5(H)×288(D)
Power consumption	WF1947 : 50 VA max. WF1948 : 75 VA max.
Operation temperature/ humidity range	0°C to +40°C, 5% to 85% RH (Absolute humidity : 1 g/m³ to 25 g/m³, no condensation)
Weight	Approx. 2.6 kg (main unit excluding accessories)
Safety and EMC	EN 61010-1:2010/EN 61326-1:2013

* Guaranteed numerical value. Other numerical values are nominal or typical (typ.) values

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