RIGOL

Performance Verification Guide

DG1000Z Series
Function / Arbitrary Waveform Generator

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RIGOL TECHNOLOGIES, INC.

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Websites: www.rigol.com

General Safety Summary

Please review the following safety precautions carefully before putting the instrument into operation so as to avoid any personal injury or damage to the instrument and any product connected to it. To prevent potential hazards, please use the instrument only specified by this manual.

Use Proper Power Cord.

Only the power cord designed for the instrument and authorized for use within the local country could be used.

Ground The Instrument.

The instrument is grounded through the Protective Earth lead of the power cord. To avoid electric shock, it is essential to connect the earth terminal of power cord to the Protective Earth terminal before any inputs or outputs.

Connect the Probe Correctly.

If a probe is used, do not connect the ground lead to high voltage since it has the isobaric electric potential as ground.

Observe All Terminal Ratings.

To avoid fire or shock hazard, observe all ratings and markers on the instrument and check your manual for more information about ratings before connecting.

Use Proper Overvoltage Protection.

Make sure that no overvoltage (such as that caused by a thunderstorm) can reach the product, or else the operator might expose to danger of electrical shock.

Do Not Operate Without Covers.

Do not operate the instrument with covers or panels removed.

Do Not Insert Anything into the Holes of Fan.

Do not insert anything into the holes of the fan to avoid damaging the instrument.

Use Proper Fuse.

Please use the specified fuses.

Avoid Circuit or Wire Exposure.

Do not touch exposed junctions and components when the unit is powered.

Do Not Operate With Suspected Failures.

If you suspect damage occurs to the instrument, have it inspected by qualified service personnel before further operations. Any maintenance, adjustment or replacement especially to circuits or accessories must be performed by **RIGOL** authorized personnel.

Keep Well Ventilation.

Inadequate ventilation may cause increasing of temperature or damages to the device. So please keep well ventilated and inspect the intake and fan regularly.

Do Not Operate in Wet Conditions.

In order to avoid short circuiting to the interior of the device or electric shock, please do not operate in a humid environment.

Do Not Operate in an Explosive Atmosphere.

In order to avoid damages to the device or personal injuries, it is important to operate the device away from an explosive atmosphere.

Keep Product Surfaces Clean and Dry.

To avoid the influence of dust and/or moisture in air, please keep the surface of device clean and dry.

Electrostatic Prevention.

Operate in an electrostatic discharge protective area environment to avoid damages induced by static discharges. Always ground both the internal and external conductors of the cable to release static before connecting.

Proper Use of Battery.

If a battery is supplied, it must not be exposed to high temperature or in contact with fire. Keep it out of the reach of children. Improper change of battery (note: lithium battery) may cause explosion. Use **RIGOL** specified battery only.

Handling Safety.

Please handle with care during transportation to avoid damages to buttons, knob interfaces and other parts on the panels.

Allgemeine Sicherheits Informationen

Überprüfen Sie diefolgenden Sicherheitshinweise sorgfältigumPersonenschädenoderSchäden am Gerätundan damit verbundenen weiteren Gerätenzu vermeiden. Zur Vermeidung vonGefahren, nutzen Sie bitte das Gerät nur so, wiein diesem Handbuchangegeben.

Um Feuer oder Verletzungen zu vermeiden, verwenden Sie ein ordnungsgemäßes Netzkabel.
Verwenden Sie für dieses Gerät nur das für ihr Land zugelassene und genehmigte Netzkabel.

Erden des Gerätes.
Das Gerät ist durch den Schutzleiter im Netzkabel geerdet. Um Gefahren durch elektrischen Schlag zu vermeiden, ist es unerlässlich, die Erdung durchzuführen. Erst dann dürfen weitere Ein- oder Ausgänge verbunden werden.

Anschluss einesTastkopfes.
Die Erdungsklemmen der Sonden sindauf dem gleichen Spannungspegel des Instruments geerdet. SchließenSie die Erdungsklemmen an keine hohe Spannung an.

Beachten Sie alle Anschlüsse.
Zur Vermeidung von Feuer oder Stromschlag, beachten Sie alle Bemerkungen und Markierungen auf dem Instrument. Befolgen Sie die Bedienungsanleitung für weitere Informationen, bevor Sie weitere Anschlüsse an das Instrument legen.

Verwenden Sie einen geeigneten Überspannungsschutz.
Stellen Sie sicher, daß keinerlei Überspannung (wie z.B. durch Gewitter verursacht) das Gerät erreichen kann. Andernfallsbestehtfür den Anwender die GefahreinesStromschlages.

Nicht ohne Abdeckung einschalten.
Betreiben Sie das Gerät nicht mit entfernten Gehäuse-Abdeckungen.

Betreiben Sie das Gerät nicht geöffnet.
Der Betrieb mit offenen oder entfernten Gehäuseteilen ist nicht zulässig. Nichts in entsprechende Öffnungen stecken (Lüfter z.B.)

Passende Sicherung verwenden.
Setzen Sie nur die spezifikationsgemäßen Sicherungen ein.

Vermeiden Sie ungeschützte Verbindungen.
Berühren Sie keine unisolierten Verbindungen oder Baugruppen, während das Gerät in Betrieb ist.

Betreiben Sie das Gerät nicht im Fehlerfall.
Wenn Sie am Gerät einen Defekt vermuten, sorgen Sie dafür, bevor Sie das Gerät wieder betreiben, dass eine Untersuchung durch qualifiziertes Kundendienstpersonal durchgeführt wird. Jedwede Wartung, Einstellarbeiten oder Austausch von Teilen am Gerät, sowie am Zubehör dürfen nur von **RIGOL** autorisiertem Personal durchgeführt werden.

Belüftung sicherstellen.
Unzureichende Belüftung kann zu Temperaturanstiegen und somit zu thermischen Schäden am Gerät führen. Stellen Sie deswegen die Belüftung sicher und kontrollieren regelmäßig Lüfter und Belüftungsöffnungen.

Nicht in feuchter Umgebung betreiben.
Zur Vermeidung von Kurzschluß im Geräteinneren und Stromschlag betreiben Sie das Gerät bitte niemals in feuchter Umgebung.

Nicht in explosiver Atmosphäre betreiben.
Zur Vermeidung von Personen- und Sachschäden ist es unumgänglich, das Gerät ausschließlich fernab jedweder explosiven Atmosphäre zu betreiben.

Geräteoberflächen sauber und trocken halten.
Um den Einfluß von Staub und Feuchtigkeit aus der Luft auszuschließen, halten Sie bitte die Geräteoberflächen sauber und trocken.

Schutz gegen elektrostatische Entladung (ESD).
Sorgen Sie für eine elektrostatisch geschützte Umgebung, um somit Schäden und Funktionsstörungen durch ESD zu vermeiden. Erden Sie vor dem Anschluß immer Innen- und Außenleiter der Verbindungsleitung, um statische Aufladung zu entladen.

Die richtige Verwendung desAkku.
Wenneine Batterieverwendet wird, vermeiden Sie hohe Temperaturen bzw. Feuer ausgesetzt werden. Bewahren Sie es außerhalbder Reichweitevon Kindern auf. UnsachgemäßeÄnderung derBatterie(Anmerkung:Lithium-Batterie)kann zu einer Explosion führen. VerwendenSie nur von RIGOLangegebenenAkkus.

Sicherer Transport.
Transportieren Sie das Gerät sorgfältig (Verpackung!), um Schäden an Bedienelementen, Anschlüssen und anderen Teilen zu vermeiden.

Document Overview

This manual is used to guide users to correctly test the performance specifications of DG1000Z series function/arbitrary waveform generator. The performance verification test mainly verifies whether DG1000Z series function/arbitrary waveform generator can work normally and is within specifications.

Main topics in this Manual:

Chapter 1 Test Overview

This chapter introduces the preparations before the performance verification test, the recommended test devices, the test result record, the test notices and the related information of the technical parameters.

Chapter 2 Performance Verification Test

This chapter introduces the test method, procedures and limits of each performance specification in details.

Appendix

The appendix provides the test results record forms and performance specifications of DG1000Z series function/arbitrary waveform generator.

Format Conventions in this Manual:

1. **Button**
   The front-panel key is denoted by the format of "Button Name (Bold) + Text Box" in the manual, for example, **Utility** denotes the "Utility" key.

2. **Menu**
   The menu is denoted by the format of "Menu Word (Bold) + Character Shading" in the manual, for example, **System** denotes the "System" menu item under **Utility**.

3. **Operation Step**
   The next step of the operation is denoted by an arrow "→" in the manual. For example, **Utility** → **System** denotes pressing **Utility** at the front panel and then pressing **System**.

Content Conventions in this Manual:

DG1000Z series function/arbitrary waveform generator includes the following models. Unless otherwise noted in this manual, DG1062Z is taken as an example to illustrate the performance verification test methods of DG1000Z series.

Model	Number of Channels	Max. Output Frequency
DG1062Z	2	60MHz
DG1032Z	2	30MHz
DG1022Z	2	25MHz

Contents

Chapter 1 Test Overview

Test Preparations

Before performing the test, make sure that the instrument is within the calibration period (the recommended calibration period is 1 year) and has been warmed up for at least 30 minutes under the specified operation temperature (18℃ to 28℃).

Recommended Test Devices

It is recommended that you use the test devices listed in the table below or other test devices whose performance specifications satisfy the "Performance Requirement" listed in the table below to test the performance specifications of the DG1000Z series.

Table 1-1 Recommended test devices

Device	Performance Requirement	Recommended Instrument
Frequency Counter	>10MHz Accuracy: 0.1ppm	Agilent 53131A
Digital Multimeter	$6^1/_2$ digits	**RIGOL** DM3068
Power Meter	-30dBm to +20dBm Accuracy: ±0.02dB Resolution: 0.01dB	Agilent E4418B
Spectrum Analyzer	Minimum resolution bandwidth is 100Hz	**RIGOL** DSA815
Oscilloscope	Bandwidth: 500MHz Rise/Fall time measurement function Overshoot measurement function	**RIGOL** DS4000 series
Connecting Cable	BNC (m)-BNC (m)	--
Connecting Cable	BNC (m)-Dual banana plug (m)	--

50Ω Load	50Ω/1W	--
Power Sensor	-30dBm to +20dBm	Agilent N8482A
Power Sensor Connecting Cable	Used to connect the power meter and power sensor	--
Adaptor	N (f)-BNC (m)	--
Adaptor	BNC (f)-N (m)	--

Test Result Record

Record and keep the test results of each test item. The test result record forms, which provide all the test items and the corresponding performance specification limits as well as spaces for users to record the test results, are provided in "**Appendix A: Test Result Record Form**" of this manual.

Tip:

It is recommended that you photocopy the test result record form before each test. During the test process, record the test results on the copies so that the forms can be used repeatedly.

Test Notices

To achieve optimum test effect, all the test procedures should follow the following recommendations.

1) Make sure that the environment temperature is between 18℃ and 28℃ and every test is performed under the specified operation temperature (18℃ to 28℃).
2) Before performing each test, make sure that the instrument has been warmed up for at least 30 minutes.
3) Before performing each test, restore the instrument to factory setting.

Technical Parameters

Chapter 2 of this manual provides the corresponding specification of each test item. Besides, "**Appendix B: Performance Specifications**" provides the detailed performance specifications of DG1000Z series.

Chapter 2 Performance Verification Test

This chapter introduces the performance verification test methods of DG1000Z series function/arbitrary waveform generator by taking CH1 of DG1062Z as an example. The test methods are also applicable to CH2.

The test items include:

- Frequency Accuracy Test
- AC Amplitude Accuracy Test
- DC Offset Accuracy Test
- AC Flatness Test
- Harmonic Distortion Test
- Spurious Signal Test
- Rise/Fall Time Test
- Overshoot Test

Frequency Accuracy Test

Specification:

Frequency characteristic	
Accuracy	±1ppm of setting value[1], 18℃ to 28℃

Note[1]: ppm denotes one part per million. For example, if the setting frequency is 1MHz and the actual output frequency is between 0.999 999MHz (-1ppm) and 1.000 001MHz (+1ppm), the instrument is up to the specification requirement and the test passes.

Test Procedures:

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG1000Z has been warmed up for at least 30 minutes. Connect the channel output terminal (take CH1 as an example; the test method is also applicable to CH2) of DG1000Z with the signal input terminal of the frequency counter using a dual-BNC cable as shown in Figure 2-1.

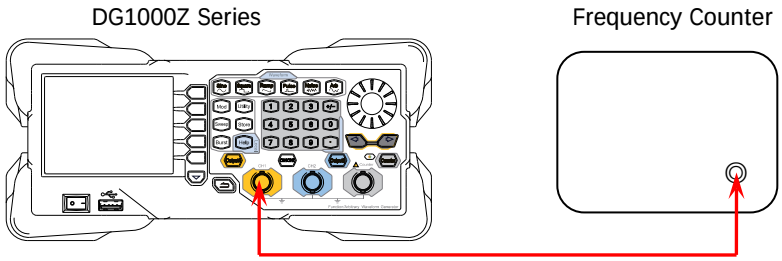

Figure 2-1 Connect DG1000Z and the Frequency Counter

2. Turn on the frequency counter and set its output impedance to 1MΩ.

3. Turn on DG1000Z. Press **Utility** → **Set To Default** → **OK** to restore DG1000Z to the factory setting.

4. Set DG1000Z:
   a) Set the output waveform of CH1 to a sine waveform with 1MHz frequency and 1Vpp amplitude.
   b) Press **Output1** to turn on the output of CH1.

5. Record the reading of the frequency counter and judge whether the reading is between 0.999 999MHz and 1.000 001MHz.

6. Set CH1 of DG1000Z to output square, ramp and pulse waveforms (the frequencies are 1MHz and the amplitudes are 1Vpp) respectively. Record the readings of the frequency counter respectively and judge whether the readings are between 0.999 999MHz and 1.000 001MHz.

7. Repeat steps 1 to 6 to test the frequency accuracy of CH2 and record the test results.

Test Record Form:

Waveform	Setting Value	Measurement Value	Specification	Pass/Fail	
Sine	Frequency: 1MHz Amplitude: 1Vpp		0.999 999MHz to 1.000 001MHz		
Square					
Ramp					
Pulse					

AC Amplitude Accuracy Test

Specification:

Output Characteristic	
Amplitude (into 50Ω)	
Accuracy	Typical (1kHz Sine, 0V_{DC} Offset, >10mVpp, Auto) ±1% of setting value ±1mV

Test Procedures:

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG1000Z has been warmed up for at least 30 minutes. Connect the 50Ω load to the channel output terminal (take CH1 as an example; the test method is also applicable to CH2) of DG1000Z; connect the 50Ω load and the voltage input terminals of the digital multimeter using a BNC-Dual banana plug connecting cable as shown in Figure 2-2.

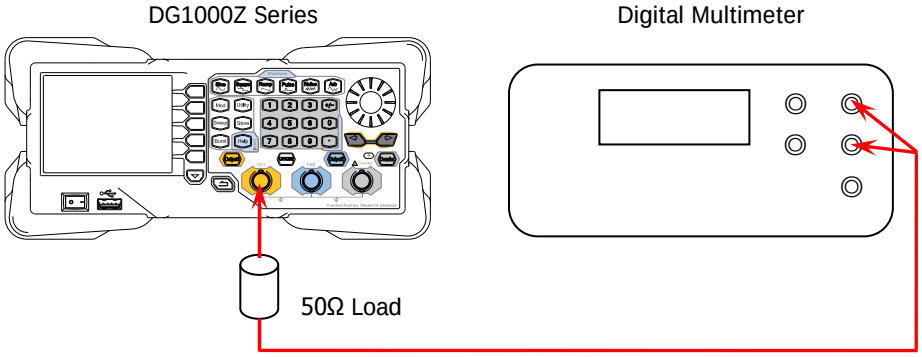

Figure 2-2 Connect DG1000Z and the Digital Multimeter via a 50Ω Load

2. Turn on the multimeter, select the ACV measurement function and set the range to “Auto”.

3. Turn on DG1000Z. Press **Utility** → **Set To Default** → **OK** to restore DG1000Z to the factory setting.

4. Set DG1000Z:
   a) Set the output impedance of CH1 to 50Ω (press **Utility** → **Channel Set** → **Output Set** → **Imped** and select “Load”).

b) Set the output waveform of CH1 to a sine waveform with 1kHz frequency, 20mVpp amplitude and $0V_{DC}$ offset.
c) Press **Output1** to turn on the output of CH1.

5. Record the reading of the multimeter and judge whether it is within the specification ("Amplitude Output Value (Vrms)" in Table 2-1) range.

6. Keep the output impedance of CH1 of DG1000Z at 50Ω and the output waveform of CH1 as a sine waveform with 1kHz frequency and $0V_{DC}$ offset. Set the output amplitude of CH1 to 100mVpp, 500mVpp, 1Vpp, 5Vpp and 10Vpp respectively. Record the readings of the multimeter respectively and judge whether the readings are within the specification ("Amplitude Output Value (Vrms)" in Table 2-1) range.

Table 2-1 Amplitude output values (Vrms) of AC amplitude accuracy test

Amplitude Setting Value (Vpp)	Allowed Error (Vpp)[1]	Amplitude Output Value (Vpp)	Amplitude Output Value (Vrms)[2]
20mVpp	±1.2mVpp	18.8mVpp to 21.2mVpp	6.6mVrms to 7.5mVrms
100mVpp	±2mVpp	98mVpp to 102mVpp	34.7mVrms to 36.1mVrms
500mVpp	±6mVpp	494mVpp to 506mVpp	174.7mVrms to 178.9mVrms
1Vpp	±11mVpp	0.989Vpp to 1.011Vpp	349.7mVrms to 357.5mVrms
5Vpp	±51mVpp	4.949Vpp to 5.051Vpp	1.75Vrms to 1.7861Vrms
10Vpp	±101mVpp	9.899Vpp to 10.101Vpp	3.5Vrms to 3.5717Vrms

Note[1]: "Allowed Error" is calculated from the specification "±1% of setting value ±1mVpp".

Note[2]: "Amplitude Output Value (Vrms)" is calculated from "Amplitude Output Value (Vpp)".

The conversion relation between Vrms and Vpp is $Vpp = 2\sqrt{2}Vrms$.

7. Repeat steps 1 to 6 to test the AC amplitude accuracy of CH2 and record the test results.

Test Record Form:

Amplitude Setting Value	Setting	Measurement Value	Specification	Pass/Fail	
20mVpp	Frequency: 1kHz Offset: $0V_{DC}$ Impedance: 50Ω		6.6mVrms to 7.5mVrms		
100mVpp			34.7mVrms to 36.1mVrms		
500mVpp			174.7mVrms to 178.9mVrms		
1Vpp			349.7mVrms to 357.5mVrms		
5Vpp			1.75Vrms to 1.7861Vrms		
10Vpp			3.5Vrms to 3.5717Vrms		

DC Offset Accuracy Test

Specification:

Output Characteristic	
Offset (into 50Ω)	
Accuracy	±(1% of setting value + 5mV + 0.5% of amplitude)

Test Procedures:

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG1000Z has been warmed up for at least 30 minutes. Connect the 50Ω load to the channel output terminal (take CH1 as an example; the test method is also applicable to CH2) of DG1000Z; connect the 50Ω load and the voltage input terminals of the digital multimeter using a BNC-Dual banana plug connecting cable as shown in Figure 2-2.

2. Turn on the multimeter, select the DCV measurement function and set the range to "20V".

3. Turn on DG1000Z. Press **Utility** → **Set To Default** → **OK** to restore DG1000Z to the factory setting.

4. Set DG1000Z:
   a) Set the output impedance of CH1 to 50Ω (press **Utility** → **Channel Set** → **Output Set** → **Imped** and select "Load").
   b) Set the output waveform of CH1 to a sine waveform with 1kHz frequency, 5Vpp amplitude and $0V_{DC}$ offset.
   c) Press **Output1** to turn on the output of CH1.

5. Record the reading of the multimeter and judge whether it is within the specification ("Offset" in Table 2-2) range.

6. Keep the output impedance of CH1 of DG1000Z at 50Ω and the output waveform of CH1 as a sine waveform with 1kHz frequency and 5Vpp amplitude. Set the offset of the output waveform of CH1 to $-2.5V_{DC}$, $-1V_{DC}$, $-500mV_{DC}$, $500mV_{DC}$, $1V_{DC}$ and $2.5V_{DC}$ respectively. Record the readings of the multimeter

respectively and judge whether the readings are within the specification ("Offset" in Table 2-2) range.

Table 2-2 Offset limits of DC offset accuracy test

Offset Setting Value	Amplitude Setting Value	Allowed Error[1]	Offset[2]
-2.5V_{DC}	5Vpp	±0.005V_{DC}	-2.505V_{DC} to -2.495V_{DC}
-1V_{DC}		±0.020V_{DC}	-1.02V_{DC} to -0.98V_{DC}
-500mV_{DC}		±0.025V_{DC}	-0.525V_{DC} to -0.475V_{DC}
0V_{DC}		±0.030V_{DC}	-0.030V_{DC} to 0.030V_{DC}
500mV_{DC}		±0.035V_{DC}	0.465V_{DC} to 0.535V_{DC}
1V_{DC}		±0.040V_{DC}	0.96V_{DC} to 1.04V_{DC}
2.5V_{DC}		±0.055V_{DC}	2.445V_{DC} to 2.555V_{DC}

Note[1]: "Allowed Error" is calculated from the specification "± (1% of setting value + 5 mV + 0.5% of amplitude)".

Note[2]: Offset = offset setting value ± allowed error.

7. Repeat steps 1 to 6 to test the DC offset accuracy of CH2 and record the test results.

Test Record Form:

Offset Setting Value	Setting	Measurement Value	Specification	Pass/Fail	
-2.5V_{DC}	Frequency: 1kHz Amplitude: 5Vpp Impedance: 50Ω		-2.505V_{DC} to -2.495V_{DC}		
-1V_{DC}			-1.02V_{DC} to -0.98V_{DC}		
-500mV_{DC}			-0.525V_{DC} to -0.475V_{DC}		
0V_{DC}			-0.030V_{DC} to 0.030V_{DC}		
500mV_{DC}			0.465V_{DC} to 0.535V_{DC}		
1V_{DC}			0.96V_{DC} to 1.04V_{DC}		
2.5V_{DC}			2.445V_{DC} to 2.555V_{DC}		

AC Flatness Test

Specification:

Output Characteristic	
Flatness	Typical (Sine, 2.5Vpp) ≤10MHz: ±0.1dB ≤60MHz: ±0.2dB

Test Procedures:

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG1000Z has been warmed up for at least 30 minutes. Connect the 50Ω load to the channel output terminal (take CH1 as an example; the test method is also applicable to CH2) of DG1000Z; connect the 50Ω load and the voltage input terminals of the digital multimeter using a BNC-Dual banana plug connecting cable as shown in Figure 2-2.

2. Turn on DG1000Z. Press **Utility** → **Set To Default** → **OK** to restore DG1000Z to the factory setting.

3. Set DG1000Z:
   a) Set the output impedance of CH1 to 50Ω (press **Utility** → **Channel Set** → **Output Set** → **Imped** and select "Load").
   b) Set the output waveform of CH1 to a sine waveform with 1kHz frequency and 2.5Vpp amplitude.
   c) Press **Output1** to turn on the output of CH1.

4. Turn on the multimeter and select the ACV measurement function. Turn on the dBm operation function and set the reference resistance to 50Ω. Read the measurement value and take it as the reference power (P_{ref}).

   Tip:

   In this step, if the dBm operation function is not turned on, you can also calculate the reference power using the formula

   $dBm = 10 \times Log_{10}[(V_{reading}{}^2 / R_{ref}) / 1mW]$ according to the measurement value of

the multimeter.

Wherein, $V_{reading}$ is the measurement value of the multimeter.

5. Calibrate the power meter:
   a) Connect the power sensor to the input terminal and **[POWER REF]** terminal of the power meter respectively.
   b) Press **Zero/Cal** → **Zero** → **Cal**. Turn on **power reference** after the calibration finishes and observe whether the measurement value of the power meter is a 0dBm, 50MHz signal.
   c) Turn off **power reference**.

6. Disconnect DG1000Z and the multimeter. Connect the power sensor and the channel output terminal (take CH1 as an example; the test method is also applicable to CH2) of DG1000Z using a BNC (f)-N (m) adaptor, as shown in Figure 2-3.

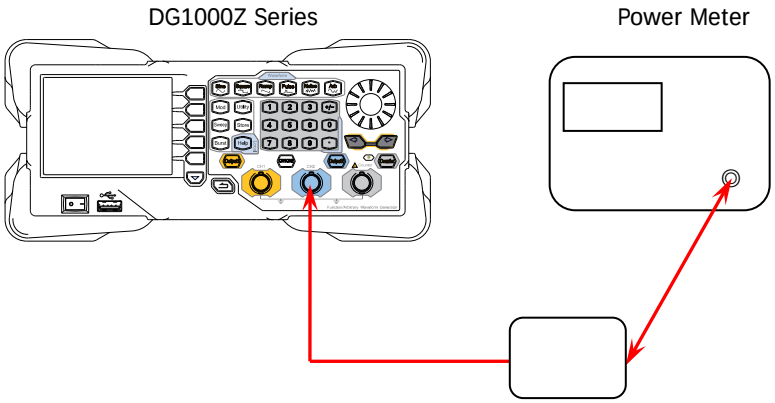

Figure 2-3 Connect DG1000Z and the Power Meter

7. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 5MHz frequency and 2.5Vpp amplitude. Set the frequency factor of the power meter to 5MHz, record the measurement value of the power meter and judge whether “measurement value-P_{ref}” is between -0.1dB and +0.1dB.

8. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 10MHz frequency and 2.5Vpp

amplitude. Set the frequency factor of the power meter to 10MHz, record the measurement value of the power meter and judge whether "measurement value-P_{ref}" is between -0.1dB and +0.1dB.

9. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 30MHz frequency and 2.5Vpp amplitude. Set the frequency factor of the power meter to 30MHz, record the measurement value of the power meter and judge whether "measurement value-P_{ref}" is between -0.2dB and +0.2dB.

10. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 60MHz frequency and 2.5Vpp amplitude. Set the frequency factor of the power meter to 60MHz, record the measurement value of the power meter and judge whether "measurement value-P_{ref}" is between -0.2dB and +0.2dB.

11. Repeat steps 1 to 10 to test the AC flatness of CH2 and record the test results.

Test Record Form:

Frequency Setting Value	Setting	Measurement Value	Calculation Result[1]	Specification	Pass/Fail	
5MHz	Amplitude: 2.5Vpp Impedance: 50Ω			±0.1dB		
10MHz						
25MHz				±0.2dB		
30MHz						
60MHz						

Note[1]: Calculation result = Measurement value - P_{ref}.

Harmonic Distortion Test

Specification:

Sine Wave Spectrum Purity	
Harmonic Distortion	Typical (0dBm) DC to 10MHz (include 10MHz): <-65dBc 10MHz to 30MHz (include 30MHz): <-55dBc 30MHz to 60MHz (include 60MHz): <-50dBc

Test Procedures:

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG1000Z has been warmed up for at least 30 minutes. Connect the channel output terminal (take CH1 as an example; the test method is also applicable to CH2) of DG1000Z with the signal input terminal of the spectrum analyzer using a dual-BNC connecting cable and N-BNC adaptor as shown in Figure 2-4.

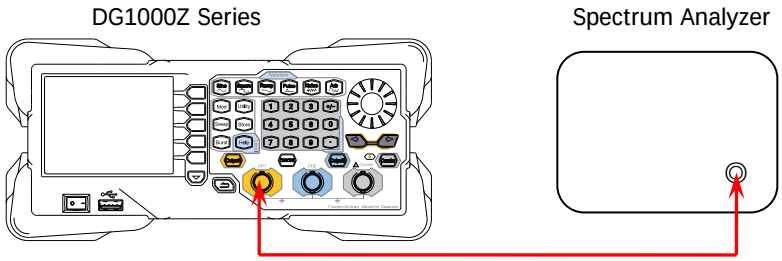

Figure 2-4 Connect DG1000Z and the Spectrum Analyzer

2. Turn on DG1000Z. Press **Utility** → **Set To Default** → **OK** to restore DG1000Z to the factory setting.

3. Set DG1000Z:
   a) Set the output impedance of CH1 to 50Ω (press **Utility** → **Channel Set** → **Output Set** → **Imped** and select “Load”).
   b) Set the output waveform of CH1 to a sine waveform with 10MHz frequency, 0dBm amplitude and $0V_{DC}$ offset.
   c) Press **Output1** to turn on the output of CH1.

4. Turn on and set the spectrum analyzer:
   a) Set the reference level to 10dBm and input attenuation to 20dB.
   b) Set the start frequency to 5MHz and stop frequency to 30MHz.
   c) Set the resolution bandwidth to 3kHz.

5. Use the cursor function to make measurements and record the measurement values of the base waveform and 2nd order harmonic. Calculate[1] the harmonic distortion and judge whether it is less than -65dBc.

6. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 30MHz frequency, 0dBm amplitude and $0V_{DC}$ offset.

7. Keep the reference level, input attenuation and resolution bandwidth of the spectrum analyzer as 10dBm, 20dB and 3kHz respectively. Set its start frequency to 20MHz and stop frequency to 70MHz.

8. Use the cursor function to make measurements and record the measurement values of the base waveform and 2nd order harmonic. Calculate[1] the harmonic distortion and judge whether it is less than -55dBc.

9. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 60MHz frequency, 0dBm amplitude and $0V_{DC}$ offset.

10. Keep the input attenuation, reference level and resolution bandwidth of the spectrum analyzer as 20dB, 10dBm and 3kHz respectively. Set its start frequency to 50MHz and stop frequency to 150MHz.

11. Use the cursor function to make measurements and record the measurement values of the base waveform and 2nd order harmonic. Calculate[1] the harmonic distortion and judge whether it is less than -50dBc.

12. Repeat steps 1 to 11 to test the harmonic distortion of CH2 and record the test results.

Note[1]: 2nd order harmonic distortion = 2nd order harmonic measurement value – base waveform

measurement value

For example, when the output waveform frequency of the channel is 10MHz, if the base waveform measurement value is 0.8dBm and the 2nd order harmonic measurement value is -66.2dBm, the 2nd order harmonic distortion = (-66.2) -0.8=-67dBc<-65dBc and the test result fulfills the specification requirement.

Test Record Form:

Frequency Setting Value	Setting	Measurement Value	Calculation Result[1]	Specification	Pass/Fail	
10MHz	Waveform: Sine Amplitude: 0dBm Offset: $0V_{DC}$	Base waveform:		<-65dBc		
		2nd order harmonic:				
25MHz		Base waveform:		<-55dBc		
		2nd order harmonic:				
30MHz		Base waveform:		<-55dBc		
		2nd order harmonic:				
60MHz		Base waveform:		<-50dBc		
		2nd order harmonic:				

Note[1]: Calculation result = 2th order harmonic measurement value - base waveform measurement value.

Spurious Signal Test

Specification:

Sine Wave Spectrum Purity (Typical 0dBm)	
Spurious signal (non-harmonic)	Typical (0dBm) ≤10MHz: <-70dBc >10MHz: <-70dBc+6dB/octave[1]

Note[1]: 6 dBc/octave means that when the frequency doubles, the specification increases by 6 dBc. For example, when the output frequency of DG1000Z is 10MHz, the specification is <-70dBc and when the output frequency is 30MHz, the specification is <-70dBc+2×6dBc, namely <-58dBc.

Test Procedures:

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG1000Z has been warmed up for at least 30 minutes. Connect the channel output terminal (take CH1 as an example; the test method is also applicable to CH2) of DG1000Z with the RF input terminal of the spectrum analyzer using a dual-BNC cable and N-BNC adaptor as shown in Figure 2-4.

2. Turn on DG1000Z. Press **Utility** → **Set To Default** → **OK** to restore DG1000Z to the factory setting.

3. Set DG1000Z:
   a) Set the output impedance of CH1 to 50Ω (press **Utility** → **Channel Set** → **Output Set** → **Imped** and select "Load").
   b) Set the output waveform of CH1 to a sine waveform with 5MHz frequency, 0dBm amplitude and $0V_{DC}$ offset.
   d) Press **Output1** to turn on the output of CH1.

4. Turn on and set the spectrum analyzer:
   a) Set the reference level to 10dBm and input attenuation to 20dB.
   b) Set the start frequency to 0Hz and stop frequency to 30MHz.
   c) Set the resolution bandwidth to 1kHz.
   d) Set the peak offset to 3dB.
   e) Set the sweep mode to single.

5. After the spectrum analyzer finishes a sweep, use **Peak** and the cursor function to measure the maximum spurious signal (except harmonics) and record the measurement result as **A**. Calculate the non-harmonic spurious signal (**A**-0dBm) and judge whether it is within the specification range.

6. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 10MHz frequency, 0dBm amplitude and $0V_{DC}$ offset.

7. Keep the reference level, input attenuation, resolution bandwidth, peak offset and sweep mode of the spectrum analyzer as 10dBm, 20dB, 1kHz, 3dB and single respectively. Set its start frequency to 0MHz and stop frequency to 50MHz.

8. Press **Sweep/Trig** → **Single** to perform a sweep.

9. After the spectrum analyzer finishes a sweep, use **Peak** and the cursor function to measure the maximum spurious signal (except harmonics) and record the measurement result as **A**. Calculate the non-harmonic spurious signal (**A**-0dBm) and judge whether it is within the specification range.

10. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 20MHz frequency, 0dBm amplitude and $0V_{DC}$ offset.

11. Keep the reference level, input attenuation, resolution bandwidth, peak offset and sweep mode of the spectrum analyzer as 10dBm, 20dB, 1kHz, 3dB and single respectively. Set its start frequency to 0MHz and stop frequency to 100MHz.

12. Repeat steps 8 and 9.

13. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 30MHz frequency, 0dBm amplitude and $0V_{DC}$ offset.

14. Keep the reference level, input attenuation, resolution bandwidth, peak offset and sweep mode of the spectrum analyzer as 10dBm, 20dB, 1kHz, 3dB and single respectively. Set its start frequency to 0MHz and stop frequency to 150MHz.

15. Repeat steps 8 and 9.

16. Keep the output impedance of CH1 of DG1000Z at 50Ω. Set the output waveform of CH1 as a sine waveform with 60MHz frequency, 0dBm amplitude and $0V_{DC}$ offset.

17. Keep the reference level, input attenuation, resolution bandwidth, peak offset and sweep mode of the spectrum analyzer as 10dBm, 20dB, 1kHz, 3dB and single respectively. Set its start frequency to 0MHz and stop frequency to 300MHz.

18. Repeat steps 8 and 9.

19. Repeat steps 1 to 18 to test the spurious signal (non-harmonic) of CH2 and record the test results.

Test Record Form:

Output Frequency	Start Frequency	Stop Frequency	A	A-0dBm	Specification	Pass/Fail	
5MHz	0Hz	30MHz			<-70dBc		
10MHz	0Hz	50MHz			<-70dBc		
20MHz	0Hz	100MHz			<-64dBc		
25MHz	0Hz	150MHz			<-58dBc		
30MHz	0Hz	150MHz			<-58dBc		
60MHz	0Hz	300MHz			<-40dBc		

Rise/Fall Time Test

Specification:

Signal Characteristic	
Square	
Rise/Fall Time	Typical (1Vpp) <10ns

Test Procedures:

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG1000Z has been warmed up for at least 30 minutes. Connect the channel output terminal (take CH1 as an example; the test method is also applicable to CH2) of DG1000Z with the signal input terminal of the oscilloscope using a dual-BNC connecting cable as shown in Figure 2-5.

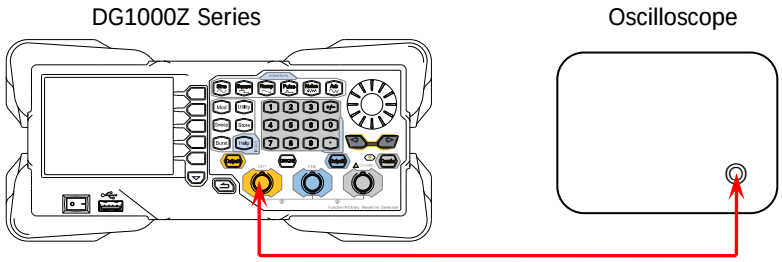

Figure 2-5 Connect DG1000Z and the Oscilloscope

2. Turn on DG1000Z. Press **Utility** → **Set To Default** → **OK** to restore DG1000Z to the factory setting.

3. Set DG1000Z:
   a) Set the output impedance of CH1 to 50Ω (press **Utility** → **Channel Set** → **Output Set** → **Imped** and select "Load").
   b) Set the output waveform of CH1 to a square waveform with 1MHz frequency, 1Vpp amplitude and $0V_{DC}$ offset.
   c) Press **Output1** to turn on the output of CH1.

4. Turn on and set the oscilloscope:
   a) Set the vertical scale to 200mV/div.
   b) Set the horizontal time base to 1ns.
   c) Adjust the trigger level to a proper value.
   d) Set the input impedance to 50Ω.
   e) Turn on the rise time and fall time measurement functions.

5. Set the edge type of the oscilloscope to rising edge, record the measurement result of the rise time and judge whether it is within the specification range.

6. Set the edge type of the oscilloscope to falling edge, record the measurement result of the fall time and judge whether it is within the specification range.

7. Repeat steps 1 to 6 to test the rise/fall time of CH2 and record the measurement results.

Test Record Form:

Waveform	Setting	Measurement Value		Specification	Pass/Fail	
Square	Frequency: 1MHz Amplitude: 1Vpp Offset: $0V_{DC}$	Rise Time		Typical (1Vpp) <10ns		
		Fall Time				

Overshoot Test

Specification:

Signal Characteristic	
Square	
Overshoot	Typical (100kHz, 1Vpp) ≤5%

Test Procedures:

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG1000Z has been warmed up for at least 30 minutes. Connect the channel output terminal (take CH1 as an example; the test method is also applicable to CH2) of DG1000Z with the signal input terminal of the oscilloscope using a dual-BNC connecting cable as shown in Figure 2-5.

2. Turn on DG1000Z. Press **Utility** → **Set To Default** → **OK** to restore DG1000Z to factory setting.

3. Set DG1000Z:
   a) Set the output impedance of CH1 to 50Ω (press **Utility** → **Channel Set** → **Output Set** → **Imped** and select "Load").
   b) Set the output waveform of CH1 to a square waveform with 100kHz frequency, 1Vpp amplitude and $0V_{DC}$ offset.
   c) Press **Output1** to turn on the output of CH1.

4. Turn on and set the oscilloscope:
   a) Set the input impedance to 50Ω.
   b) Set the vertical scale to 200mV/div.
   c) Set the horizontal time base to 50ns.
   d) Adjust the trigger level to a proper value.
   e) Turn on the overshoot measurement function.

5. Record the overshoot measurement value and judge whether it is within the specification range.

6. Repeat steps 1 to 5 to test the overshoot of CH2 and record the measurement result.

Test Record Form:

Waveform	Setting	Measurement Value	Specification	Pass/Fail
Square	Frequency: 100kHz Amplitude: 1Vpp Offset: $0V_{DC}$		Typical (100kHz, 1Vpp) <5%	

Appendix

Appendix A: Test Result Record Form

RIGOL DG1000Z Series Function/Arbitrary Waveform Generator
Performance Verification Test Record Form

Model: _____ Tested by:_____ Test Date:_____

Channel: CH1

Frequency Accuracy Test

Waveform	Setting Value	Measurement Value	Specification	Pass/Fail	
Sine	Frequency: 1MHz Amplitude: 1Vpp		0.999 999MHz to 1.000 001MHz		
Square					
Ramp					
Pulse					

AC Amplitude Accuracy Test

Amplitude Setting Value	Setting	Measurement Value	Specification	Pass/Fail	
20mVpp	Frequency: 1kHz Offset: $0V_{DC}$ Impedance: 50Ω		6.6mVrms to 7.5mVrms		
100mVpp			34.7mVrms to 36.1mVrms		
500mVpp			174.7mVrms to 178.9mVrms		
1Vpp			349.7mVrms to 357.5mVrms		
5Vpp			1.75Vrms to 1.7861Vrms		
10Vpp[1]			3.5Vrms to 3.5717Vrms		

Note[1]: Only applicable to DG1062Z.

DC Offset Accuracy Test

Offset Setting Value	Setting	Measurement Value	Specification	Pass/Fail	
-2.5V_{DC}	Frequency: 1kHz Amplitude: 5Vpp Impedance: 50Ω		-2.505V_{DC} to -2.495V_{DC}		
-1V_{DC}			-1.02V_{DC} to -0.98V_{DC}		
-500mV_{DC}			-0.525V_{DC} to -0.475V_{DC}		
0V_{DC}			-0.030V_{DC} to 0.030V_{DC}		
500mV_{DC}			0.465V_{DC} to 0.535V_{DC}		
1V_{DC}			0.96V_{DC} to 1.04V_{DC}		
2.5V_{DC}			2.445V_{DC} to 2.555V_{DC}		

AC Flatness Test

Frequency Setting Value	Setting	Measurement Value	Calculation Result	Specification	Pass/Fail	
5MHz	Amplitude: 2.5Vpp Impedance: 50Ω			±0.1dB		
10MHz						
25MHz				±0.2dB		
30MHz[1]						
60MHz[2]						

Note[1]: Only applicable to DG1032Z and DG1062Z.

Note[2]: Only applicable to DG1062Z.

Harmonic Distortion Test

Frequency Setting Value	Setting	Measurement Value	Calculation Result	Specification	Pass/Fail	
10MHz	Waveform: Sine Amplitude: 0dBm Offset: $0V_{DC}$	Base waveform:		<-65dBc		
		2nd order harmonic:				
25MHz		Base waveform:		<-55dBc		
		2nd order harmonic:				
30MHz[1]		Base waveform:		<-55dBc		
		2nd order harmonic:				
60MHz[2]		Base waveform:		<-50dBc		
		2nd order harmonic:				

Note[1]: Only applicable to DG1032Z and DG1062Z.

Note[2]: Only applicable to DG1062Z.

Spurious Signal Test

Output Frequency	Start Frequency	Stop Frequency	A	A-0dBm	Specification	Pass/Fail	
5MHz	0Hz	30MHz			<-70dBc		
10MHz	0Hz	50MHz			<-70dBc		
20MHz	0Hz	100MHz			<-64dBc		
25MHz	0Hz	150MHz			<-58dBc		
30MHz[1]	0Hz	150MHz			<-58dBc		
60MHz[2]	0Hz	300MHz			<-40dBc		

Note[1]: Only applicable to DG1032Z and DG1062Z.

Note[2]: Only applicable to DG1062Z.

Rise/Fall Time Test

Waveform	Setting	Measurement Value		Specification	Pass/Fail	
Square	Frequency: 1MHz Amplitude: 1Vpp Offset: $0V_{DC}$	Rise Time		Typical (1Vpp) <10ns		
		Fall Time				

Overshoot Test

Waveform	Setting	Measurement Value	Specification	Pass/Fail
Square	Frequency: 100kHz Amplitude: 1Vpp Offset: $0V_{DC}$		Typical (100kHz, 1Vpp) <5%	

Channel: CH2

Frequency Accuracy Test

Waveform	Setting Value	Measurement Value	Specification	Pass/Fail	
Sine	Frequency: 1MHz Amplitude: 1Vpp		0.999 999MHz to 1.000 001MHz		
Square					
Ramp					
Pulse					

AC Amplitude Accuracy Test

Amplitude Setting Value	Setting	Measurement Value	Specification	Pass/Fail	
20mVpp	Frequency: 1kHz Offset: $0V_{DC}$ Impedance: 50Ω		6.6mVrms to 7.5mVrms		
100mVpp			34.7mVrms to 36.1mVrms		
500mVpp			174.7mVrms to 178.9mVrms		
1Vpp			349.7mVrms to 357.5mVrms		
5Vpp			1.75Vrms to 1.7861Vrms		
10Vpp[1]			3.5Vrms to 3.5717Vrms		

Note[1]: Only applicable to DG1062Z.

DC Offset Accuracy Test

Offset Setting Value	Setting	Measurement Value	Specification	Pass/Fail	
$-2.5V_{DC}$	Frequency: 1kHz Amplitude: 5Vpp Impedance: 50Ω		$-2.505V_{DC}$ to $-2.495V_{DC}$		
$-1V_{DC}$			$-1.02V_{DC}$ to $-0.98V_{DC}$		
$-500mV_{DC}$			$-0.525V_{DC}$ to $-0.475V_{DC}$		
$0V_{DC}$			$-0.030V_{DC}$ to $0.030V_{DC}$		
$500mV_{DC}$			$0.465V_{DC}$ to $0.535V_{DC}$		
$1V_{DC}$			$0.96V_{DC}$ to $1.04V_{DC}$		
$2.5V_{DC}$			$2.445V_{DC}$ to $2.555V_{DC}$		

AC Flatness Test

Frequency Setting Value	Setting	Measurement Value	Calculation Result	Specification	Pass/Fail	
5MHz	Amplitude: 2.5Vpp Impedance: 50Ω			±0.1dB		
10MHz						
25MHz				±0.2dB		
30MHz[1]						
60MHz[2]						

Note[1]: Only applicable to DG1032Z and DG1062Z.

Note[2]: Only applicable to DG1062Z.

Harmonic Distortion Test

Frequency Setting Value	Setting	Measurement Value	Calculation Result	Specification	Pass/Fail	
10MHz	Waveform: Sine Amplitude: 0dBm Offset: $0V_{DC}$	Base waveform:		<-65dBc		
		2nd order harmonic:				
25MHz		Base waveform:		<-55dBc		
		2nd order harmonic:				
30MHz[1]		Base waveform:		<-55dBc		
		2nd order harmonic:				
60MHz[2]		Base waveform:		<-50dBc		
		2nd order harmonic:				

Note[1]: Only applicable to DG1032Z and DG1062Z.

Note[2]: Only applicable to DG1062Z.

Spurious Signal Test

Output Frequency	Start Frequency	Stop Frequency	A	A-0dBm	Specification	Pass/Fail	
5MHz	0Hz	30MHz			<-70dBc		
10MHz	0Hz	50MHz			<-70dBc		
20MHz	0Hz	100MHz			<-64dBc		
25MHz	0Hz	150MHz			<-58dBc		
30MHz[1]	0Hz	150MHz			<-58dBc		
60MHz[2]	0Hz	300MHz			<-40dBc		

Note[1]: Only applicable to DG1032Z and DG1062Z.

Note[2]: Only applicable to DG1062Z.

Rise/Fall Time Test

Waveform	Setting	Measurement Value		Specification	Pass/Fail	
Square	Frequency: 1MHz Amplitude: 1Vpp Offset: $0V_{DC}$	Rise Time		Typical (1Vpp) <10ns		
		Fall Time				

Overshoot Test

Waveform	Setting	Measurement Value	Specification	Pass/Fail
Square	Frequency: 100kHz Amplitude: 1Vpp Offset: $0V_{DC}$		Typical (100kHz, 1Vpp) <5%	

Appendix B: Performance Specifications

Unless otherwise specified, all the specifications can be guaranteed if the following two conditions are met.

- The generator is within the calibration period and has performed self-calibration.
- The generator has been working continuously for at least 30 minutes under the specified temperature (18℃~28℃).

All the specifications are guaranteed unless those marked with “typical”.

Model	DG1022Z	DG1032Z	DG1062Z
Channel	2	2	2
Maximum Frequency	25MHz	30MHz	60MHz
Sample Rate	200MSa/s		

Waveforms	
Basic waveforms	Sine, Square, Ramp, Pulse, Noise
Built-in Arbitrary Waveforms	160 kinds, including Sinc, Exponential Rise, Exponential Fall, ECG, Gauss, HaverSine, Lorentz, Dual-Tone, etc.

Frequency Characteristics			
Sine	1μHz to 25MHz	1μHz to 30MHz	1μHz to 60MHz
Square	1μHz to 25MHz	1μHz to 25MHz	1μHz to 25MHz
Ramp	1μHz to 500kHz	1μHz to 500kHz	1μHz to 1MHz
Pulse	1μHz to 15MHz	1μHz to 15MHz	1μHz to 25MHz
Harmonic	1μHz to 10MHz	1μHz to 10MHz	1μHz to 20MHz
Noise (-3dB)	25MHz bandwidth	30MHz bandwidth	60MHz bandwidth
Arbitrary Waveform	1μHz to 10MHz	1μHz to 10MHz	1μHz to 20MHz
Resolution	1μHz		
Accuracy	±1ppm of the settings, 18℃ to 28℃		

Sine Wave Spectrum Purity	
Harmonic Distortion	Typical (0dBm) DC-10MHz (included): <-65dBc 10MHz-30MHz (included): <-55dBc 30MHz-60MHz (included): <-50dBc
Total Harmonic Distortion	<0.075% (10Hz-20kHz, 0dBm)
Spurious (non-harmonic)	Typical (0dBm) ≤10MHz: <-70dBc >10MHz: <-70dBc+6dB/octave
Phase Noise	Typical (0dBm, 10kHz deviation) 10MHz: <-125dBc/Hz

Signal Characteristics	
Square	
Rise/Fall Time	Typical (1Vpp) <10ns
Overshoot	Typical (100KHz, 1Vpp) ≤5%
Duty Cycle	0.01% to 99.99% (limited by the current frequency setting)
Non-symmetry	1% of period+5ns
Jitter (rms)	Typical (1MHz, 1Vpp, 50Ω) ≤5MHz: 2ppm+200ps >5MHz: 200ps
Ramp	
Linearity	≤1% of peak output (typical, 1kHz, 1Vpp, 100% Symmetry)
Symmetry	0% to 100%
Pulse	
Pulse Width	16ns to 999.999 982 118ks (limited by the current frequency setting)
Duty Cycle	0.001% to 99.999% (limited by the current frequency setting)
Leading/Trailing	≥10ns

Edge Time	(limited by the current frequency and pulse width settings)
Overshoot	Typical (1Vpp) ≤5%
Jitter (rms)	Typical (1Vpp) ≤5MHz: 2ppm+200ps >5MHz: 200ps
Arb	
Waveform Length	8pts to 2Mpts (16Mpts optional) 8pts to 8Mpts (16Mpts optional)
Vertical Resolution	14bits
Sample Rate	200MSa/s
Minimum Rise/Fall Time	Typical (1Vpp) <10ns
Jitter (rms)	Typical (1Vpp) ≤5MHz: 2ppm+200ps >5MHz: 200ps
Edit Method	Edit Points, Edit Block, Insert Waveform
Harmonic	
Harmonic Order	≤8
Harmonic Type	Even, Odd, All, User
Harmonic Amplitude	can be set for all harmonics
Harmonic Phase	can be set for all harmonics

Output Characteristics	
Amplitude (into 50 Ω)	
Range	≤10MHz: 1.0mVpp to 10Vpp ≤30MHz: 1.0mVpp to 5.0Vpp ≤60MHz: 1.0mVpp to 2.5Vpp
Accuracy	Typical (1kHz Sine, 0V Offset, >10mVpp, Auto) ±1% of setting ± 1mV
Flatness	Typical (Sine 2.5Vpp) ≤10MHz: ±0.1dB ≤60MHz: ±0.2dB
Units	Vpp, Vrms, dBm
Resolution	0.1mVpp or 4digits

Offset (into 50 Ω)	
Range (Peak ac+dc)	±5Vpk ac+dc
Accuracy	±(1% of setting+5mV+0.5% of amplitude)
Waveform Output	
Impedance	50Ω (typical)
Protection	Short-circuit protection, automatically disable waveform output when overload occurs

Modulation Characteristics	
Modulation Type	AM, FM, PM, ASK, FSK, PSK, PWM
AM	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Depth	0% to 120%
Modulating Frequency	2mHz to 1MHz
FM	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Modulating Frequency	2mHz to 1MHz
PM	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Phase Deviation	0° to 360°
Modulating Frequency	2mHz to 1MHz
ASK	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Square with 50% duty cycle
Key Frequency	2mHz to 1MHz
FSK	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External

Modulating Waveform	Square with 50% duty cycle
Key Frequency	2mHz to 1MHz
PSK	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Square with 50% duty cycle
Key Frequency	2mHz to 1MHz
PWM	
Carrier Waveform	Pulse
Source	Internal/External
Modulating Waveforms	Sine, Square, Ramp, Noise, Arb
Width Deviation	0% to 100% of Pulse Width
Modulating Frequency	2mHz to 1MHz
[Mod/Trig/FSK/Sync] Input	
Input Range	75mVRMS to ±5Vac+dc
Input Bandwidth	50kHz
Input Impedance	10kΩ

Burst Characteristics			
Carrier Waveform	Sine, Square, Ramp, Pulse, Noise, Arb (except DC)		
Carrier Frequency	2mHz to 25MHz	2mHz to 30MHz	2mHz to 60MHz
Burst Count	1 to 1,000,000 or Infinite		
Start/Stop Phase	0° to 360°, 0.1° resolution		
Internal Period	1μs to 500s		
Gated Source	External Trigger		
Trigger Source	Internal, External or Manual		
Trigger Delay	0ns to 100s		

Sweep Characteristics	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Type	Linear, Log or Step
Direction	Up/Down
Start/Stop Frequency	Consistent with the upper/lower limit of the frequency of

	the carrier waveform
Sweep Time	1ms to 500s
Hold/Return Time	0ms to 500s
Trigger Source	Internal, External or Manual
Mark	Falling edge of the Sync signal (programmable)

Counter			
Function	Frequency, Period, Positive/Negative Pulse Width, Duty Cycle		
Frequency Resolution	7 digits/second (Gate Time =1s)		
Frequency Range	1μHz to 200MHz		
Period Measurement	Measurement Range	5ns to 16 days	
Voltage Range and Sensitivity (Not modulation signal)			
DC Coupling	DC Offset Range	±1.5Vdc	
	1μHz to 100MHz	50mVRMS to ±2.5Vac+dc	
	100MHz to 200MHz	100mVRMS to ±2.5Vac+dc	
AC Coupling	1μHz to 100MHz	50mVRMS to ±2.5Vpp	
	100MHz to 200MHz	100mVRMS to ±2.5Vpp	
Pulse Width and Duty Cycle Measurement			
Frequency/Amplitude Range	1μHz to 25MHz	50mVRMS to ±2.5Vac+dc	DC Coupling
Pulse Width	Minimum	≥20ns	
	Resolution	5ns	
Duty Cycle	Range (Display)	0% to 100%	
Input Characteristics			
Input Signal Range	Breakdown Voltage	±7Vac+dc	Impedance= 1MΩ
Input Adjustment	Coupling	AC	DC
	HF Suppression	ON: input bandwidth=250kHz; OFF: input bandwidth=200MHz	
Input Trigger	Trigger Level Range	-2.5V to +2.5V	
	Trigger Sensitivity Range	0% (about 140mV hysteresis voltage) to 100% (about 2mV hysteresis voltage)	

Gate Time	GateTime1	1.310ms
	GateTime2	10.48ms
	GateTime3	166.7ms
	GateTime4	1.342s
	GateTime5	10.73s
	GateTime6	>10s

Trigger Characteristics	
Trigger Input	
Level	TTL-compatible
Slope	Rising or falling (optional)
Pulse Width	>100ns
Latency	Sweep: <100ns (typical) Burst: <300ns (typical)
Trigger Output	
Level	TTL-compatible
Pulse Width	>60ns (typical)
Maximum Frequency	1MHz

Two-channel Characteristics - Phase Offset	
Range	0° to 360°
Waveform Phase Resolution	0.03°

Clock Reference	
External Reference Input	
Lock Range	10MHz±50Hz
Level	250mVpp to 5Vpp
Lock Time	<2s
Impedance (typical)	1kΩ, AC coupling
Internal Reference Output	
Frequency	10MHz±50Hz
Level	3.3Vpp

Impedance (typical)	50Ω, AC coupling

Sync Output	
Level	TTL-compatible
Impedance	50Ω, nominal value

Overvoltage Protection
Overvoltage protection will take effect once any of the following two conditions is met: ● The amplitude setting in the generator is greater than 2Vpp or the output offset is greater than $\|2V_{DC}\|$, the input voltage is greater than ±11.5×(1±5%)V (<10kHz). ● The amplitude setting in the generator is lower than or equal to 2Vpp or the output offset is lower than or equal to $\|2V_{DC}\|$, the input voltage is greater than ±3.5×(1±5%)V (<10kHz).

General Specifications	
Power	
Power Voltage	100V to 240V (45Hz to 440Hz)
Power Consumption	Less than 40W
Fuse	250V, T3.15A
Display	
Type	3-inch TFT LCD
Resolution	320 Horizontal×RGB×240 Vertical Resolution
Color	16M color
Environment	
Temperature Range	Operating: 0℃ to 50℃ Non-Operating: -40℃ to 70℃
Cooling Method	Cooling by fans compulsively
Humidity Range	Less than 30℃: ≤95% Relative Humidity (RH) 30℃ to 40℃: ≤75% Relative Humidity (RH) 40℃ to 50℃: ≤45% Relative Humidity (RH)
Altitude	Operating: Less than 3000 meters Non-Operating: Less than 15,000 meters

Mechanical	
Dimensions (W×H×D)	261.5mm×112mm×318.4mm
Weight	without package: 3.2kg with package: 4.5kg
Interfaces	USB Host, USB Device, LAN
IP Protection	IP2X
Calibration Interval	Recommend calibration interval is one year

Authentication Information		
EMC	In line with EN61326-1:2006	
	IEC 61000-3-2:2000	±4.0kV (Contact Discharge) ±4.0kV (Air Discharge)
	IEC 61000-4-3:2002	3V/m (80MHz to 1GHz) 3V/m (1.4GHz to 2GHz) 1V/m (2.0GHz to 2.7GHz)
	IEC 61000-4-4:2004	1kV power lines
	IEC 61000-4-5:2001	0.5kV (Phase to Neutral) 0.5kV (Phase to PE) 1kV (Neutral to PE)
	IEC 61000-4-6:2003	3V, 0.15-80MHz
	EC 61000-4-11:2004	Voltage dip: 0%UT during half cycle 0%UT during 1 cycle 70%UT during 25 cycle Short interruption: 0%UT during 1 cycle
Electrical Safety	In line with USA: UL 61010-1:2012 Canada: CAN/CSA-C22.2 No. 61010-1-2012 EN 61010-1:2010	