RIGOL

Performance Verification Guide

DG900 Series
Function/Arbitrary Waveform Generator

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RIGOL (SUZHOU) TECHNOLOGIES INC.

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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 follow the instructions specified in this manual to use the instrument properly.

Use the BNC Output Connector Properly.
The BNC output connector on the front panel only allows to output the signal but not to input the signal.

Use Proper Power Cord.
Only the exclusive 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, connect the earth terminal of the power cord to the Protective Earth terminal before connecting any input or output terminals.

Connect the Probe Correctly.
If a probe is used, the probe ground lead must be connected to earth ground. Do not connect the ground lead to high voltage. Improper way of connection could result in dangerous voltages being present on the connectors, controls or other surfaces of the oscilloscope and probes, which will cause potential hazards for operators.

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 the instrument.

Use Proper Overvoltage Protection.
Ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the operator might be exposed to the danger of an electric shock.

Do Not Operate Without Covers.
Do not operate the instrument with covers or panels removed.

Do Not Insert Objects Into the Air Outlet.
Do not insert objects into the air outlet, as doing so may cause damage to 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 on.

Do Not Operate With Suspected Failures.
If you suspect that any damage may occur to the instrument, have it inspected by **RIGOL** authorized personnel before further operations. Any maintenance, adjustment or replacement especially to circuits or accessories must be performed by **RIGOL** authorized personnel.

Provide Adequate Ventilation.
Inadequate ventilation may cause an increase of temperature in the instrument, which would cause damage to the instrument. So please keep the instrument well ventilated and inspect the air outlet and the fan regularly.

Do Not Operate in Wet Conditions.
To avoid short circuit inside the instrument or electric shock, never operate the instrument in a humid environment.

Do Not Operate in an Explosive Atmosphere.
To avoid personal injuries or damage to the instrument, never operate the instrument in an explosive atmosphere.

Keep Product Surfaces Clean and Dry.
To avoid dust or moisture from affecting the performance of the instrument, keep the surfaces of the instrument clean and dry.

Prevent Electrostatic Impact.
Operate the instrument in an electrostatic discharge protective environment to avoid damage induced by static discharges. Always ground both the internal and external conductors of cables to release static before making connections.

Use the Battery Properly.
Do not expose the battery (if available) to high temperature or fire. Keep it out of the reach of children. Improper change of a battery (lithium battery) may cause an explosion. Use the **RIGOL** specified battery only.

Handle with Caution.
Please handle with care during transportation to avoid damage to keys, knobs, interfaces, and other parts on the panels.

Document Overview

This manual is used to guide users to correctly test the performance specifications of DG900 series function/arbitrary waveform generator. The performance verification test mainly verifies whether DG900 series 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 DG900 series function/arbitrary waveform generator.

Format Conventions in this Manual:

1. **Keys:**
   The keys on the front panel are usually denoted by the format of "Key Name (Bold) + Text Box". For example, **Utility** denotes the Utility key.

2. **Menu Labels:**
   The menu labels are usually denoted by the format of "Menu Word (Bold) + Character Shading". For example, **System Setting**.

3. **Connectors:**
   The connectors on the front or rear panel are usually denoted by the format of "Connector Name (Bold) + Square Brackets (Bold)". For example, **[Counter]**.

4. **Operation Procedures:**
   "→" represents the next step of operation. For example, **Utility** → **System Setting** denotes that first press **Utility** on the front panel, and then tap the **System Setting** menu label.

Content Conventions in this Manual:

DG900 series function/arbitrary waveform generator includes the following models. Unless otherwise noted in this manual, DG992 is taken as an example to illustrate the performance verification test methods of DG900 series.

Model	No. of Channels	Max. Output Frequency
DG952	2	50 MHz
DG972	2	70 MHz
DG992	2	100 MHz

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 DG900 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 DG900 series.

Chapter 2 Performance Verification Test

This chapter introduces the performance verification test methods of DG900 series function/arbitrary waveform generator by taking CH1 of DG992 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	±(1 ppm[1] of the setting value + 10 pHz), 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 0.999 998 999 999 999 99MHz and 1.000 001 000 000 000 01MHz, 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 DG900 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 DG900 with the signal input terminal of the frequency counter using a dual-BNC cable as shown in Figure 2-1.

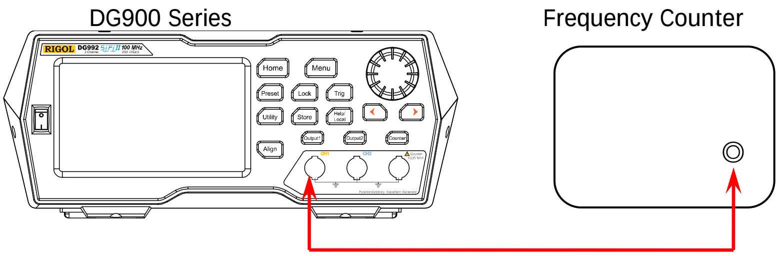


Figure 2-1 Connect DG900 and the Frequency Counter

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

3. Turn on DG900. Press **Preset** and tap the **Def** icon, then a dialog box is displayed, tap **"Apply"** to restore DG900 to the factory setting.

4. Set DG900:
   a) Set the output waveform of CH1 to a sine waveform with 1MHz frequency and 1Vpp amplitude.
   b) Press **Output1** or tap the channel output configuration status bar 

 to turn on the output of CH1 in the channel setting interface.

5. Record the reading of the frequency counter and judge whether the reading is between 0.999 998 999 999 999 99MHz and 1.000 001 000 000 000 01MHz.

6. Set CH1 of DG900 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

0.999 998 999 999 999 99MHz and 1.000 001 000 000 000 01MHz.

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		0.999 998 999 999 999 99MHz to 1.000 001 000 000 000 01MHz		
Square					
Ramp					
Pulse					

AC Amplitude Accuracy Test

Specification

Output Characteristic	
Amplitude (into 50Ω)	
Accuracy	Typical (1kHz Sine, 0V Offset, >10mVpp, Auto) ±(1% of setting value) ±5mV

Test Procedures

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG900 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 DG900; 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.

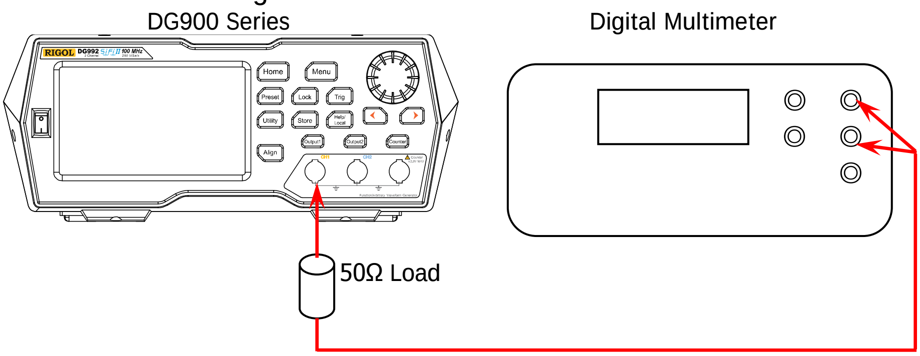


Figure 2-2 Connect DG900 and the Digital Multimeter via a 50Ω Load

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

3. Turn on DG900. Press **Preset** and tap the **Def** icon, then a dialog box is displayed, tap **"Apply"** to restore DG900 to the factory setting.

4. Set DG900:
   a) Set the output impedance of CH1 to 50Ω. (Tap the channel output configuration status bar  under the user interface to enter the channel setting interface. Tap the **OutputSet** → **HighZ** to select "Off". Tap the **Impedance** menu label, and set the impedance to 50Ω.)
   b) Set the output waveform of CH1 to a sine waveform with 1kHz frequency, 20mVpp amplitude and $0V_{dc}$ offset.
   c) Press **Output1** or tap the channel output configuration status bar

to turn on the output of CH1 in the channel setting interface.

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 DG900 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	±5.2mVpp	14.8mVpp to 25.2mVpp	5.2mVrms to 8.9mVrms
100mVpp	±6mVpp	94mVpp to 106mVpp	33.2mVrms to 37.5mVrms
500mVpp	±10mVpp	490mVpp to 510mVpp	173.3mVrms to 180.3mVrms
1Vpp	±15mVpp	0.985Vpp to 1.015Vpp	348.3mVrms to 358.9mVrms
5Vpp	±55mVpp	4.945Vpp to 5.055Vpp	1.75Vrms to 1.7875Vrms
10Vpp	±105mVpp	9.895Vpp to 10.105Vpp	3.5Vrms to 3.5732Vrms

Note[1]: "Allowed Error" is calculated from the specification "±(1% of setting value) ±5mVpp".
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		5.2mVrms to 8.9mVrms		
100mVpp			33.2mVrms to 37.5mVrms		
500mVpp			173.3mVrms to 180.3mVrms		
1Vpp			348.3mVrms to 358.9mVrms		
5Vpp			1.75Vrms to 1.7875Vrms		
10Vpp			3.5Vrms to 3.5732Vrms		

DC Offset Accuracy Test

Specification

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

Test Procedures

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG900 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 DG900; 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 DG900. Press **Preset** and tap the **Def** icon, then a dialog box is displayed, tap **"Apply"** to restore DG900 to the factory setting.

4. Set DG900:
   a) Set the output impedance of CH1 to 50Ω. (Tap the channel output configuration status bar 

   under the user interface to enter the channel setting interface. Tap the **OutputSet** → **HighZ** to select "Off". Tap the **Impedance** menu label, and set the impedance to 50Ω.)
   b) Set the output waveform of CH1 to a sine waveform with 1kHz frequency, 5Vpp amplitude and $0V_{dc}$ offset.
   c) Press **Output1** or tap the channel output configuration status bar 

   to turn on the output of CH1 in the channel setting interface.

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 DG900 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	±0.030V_{dc}	-2.530V_{dc} to -2.470V_{dc}
-1V_{dc}		±0.045V_{dc}	-1.045V_{dc} to -0.955V_{dc}
-500mV_{dc}		±0.050V_{dc}	-0.550V_{dc} to -0.450V_{dc}
0V_{dc}		±0.055V_{dc}	-0.055V_{dc} to 0.055V_{dc}
500mV_{dc}		±0.060V_{dc}	0.440V_{dc} to 0.560V_{dc}
1V_{dc}		±0.065V_{dc}	0.935V_{dc} to 1.065V_{dc}
2.5V_{dc}		±0.080V_{dc}	2.420V_{dc} to 2.580V_{dc}

Note[1]: "Allowed Error" is calculated from the specification "± (1% of setting value + 5 mV + 1% 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		-2.530V_{dc} to -2.470V_{dc}	
-1V_{dc}			-1.045V_{dc} to -0.955V_{dc}	
-500mV_{dc}			-0.550V_{dc} to -0.450V_{dc}	
0V_{dc}			-0.055V_{dc} to 0.055V_{dc}	
500mV_{dc}			0.440V_{dc} to 0.560V_{dc}	
1V_{dc}			0.935V_{dc} to 1.065V_{dc}	
2.5V_{dc}			2.420V_{dc} to 2.580V_{dc}	

AC Flatness Test

Specification

Output Characteristic	
Flatness	Typical (Sine, 1 Vpp) ≤5 MHz: ±0.1 dB ≤15 MHz: ±0.2 dB ≤25 MHz: ±0.3 dB ≤40MHz: ±0.5 dB >40 MHz: ±1 dB

Test Procedures

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG900 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 DG900; 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 DG900. Press **Preset** and tap the **Def** icon, then a dialog box is displayed, tap **"Apply"** to restore DG900 to the factory setting.

3. Set DG900:
   a) Set the output impedance of CH1 to 50Ω. (Tap the channel output configuration status bar  under the user interface to enter the channel setting interface. Tap the **OutputSet** → **HighZ** to select "Off". Tap the **Impedance** menu label, and set the impedance to 50Ω.)
   b) Set the output waveform of CH1 to a sine waveform with 1kHz frequency and 1Vpp amplitude.
   c) Press **Output1** or tap the channel output configuration status bar  to turn on the output of CH1 in the channel setting interface.

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 DG900 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 DG900 using a BNC (f)-N (m) adaptor, as shown in Figure 2-3.

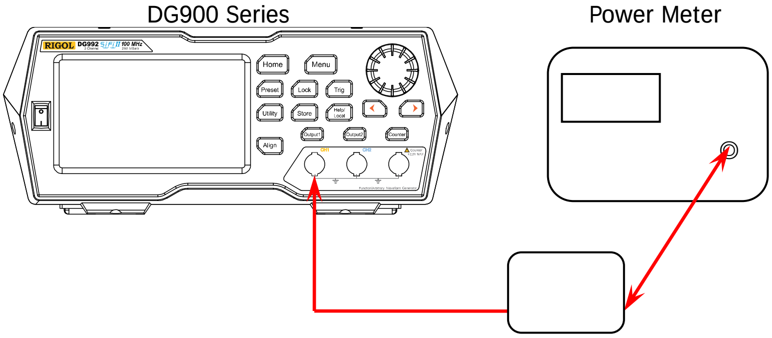


Figure 2-3 Connect DG900 and the Power Meter

7. Keep the output impedance of CH1 of DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 5MHz frequency and 1Vpp 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 DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 10MHz frequency and 1Vpp 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 -0.2dB and +0.2dB.

9. Keep the output impedance of CH1 of DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 15MHz frequency and 1Vpp amplitude. Set the frequency factor of the power meter to 15MHz, 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 DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 20MHz frequency and 1Vpp amplitude. Set the frequency factor of the power meter to 20MHz, record the measurement value of the power meter and judge whether “measurement value-P_{ref}” is between -0.3dB and +0.3dB.

11. Keep the output impedance of CH1 of DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 25MHz frequency and 1Vpp amplitude. Set the frequency factor of the power meter to 25MHz, record the measurement value of the power meter and judge whether “measurement value-P_{ref}” is between -0.3dB and +0.3dB.

12. Keep the output impedance of CH1 of DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 30MHz frequency and 1Vpp 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 -0.5dB and +0.5dB.

13. Keep the output impedance of CH1 of DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 40MHz frequency and 1Vpp amplitude. Set the frequency factor of the power meter to 40MHz, record the measurement value of the power meter and judge whether “measurement value-P_{ref}” is between -0.5dB and +0.5dB.

14. Keep the output impedance of CH1 of DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 50MHz frequency and 1Vpp amplitude. Set the frequency factor of the power meter to 50MHz, record the measurement value of the power meter and judge whether “measurement value-P_{ref}” is between -1dB and +1dB.

15. Repeat steps 1 to 14 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: 1Vpp Impedance: 50Ω			±0.1dB		
10MHz				±0.2dB		
15MHz				±0.2dB		
20MHz				±0.3dB		
25MHz				±0.3dB		
30MHz				±0.5dB		
40MHz				±0.5dB		
50MHz				±1dB		

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

Harmonic Distortion Test

Specification

Sine Wave Spectrum Purity	
Harmonic Distortion	Typical[1] DC to 10 MHz (included): <-55 dBc 10 MHz to 20 MHz (included): <-50 dBc 20 MHz to 40 MHz (included): <-40 dBc >40 MHz: <-35 dBc

Note[1]: 0 dBm output, DC offset 0, impedance 50 Ω.

Test Procedures

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG900 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 DG900 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.

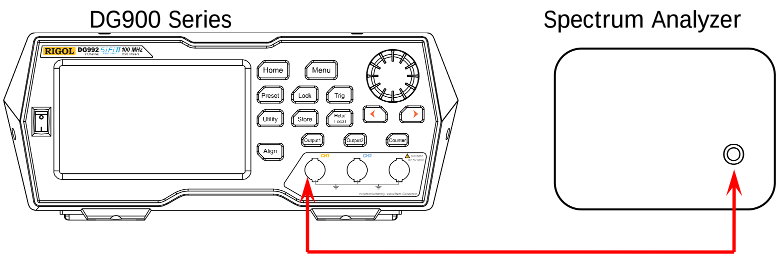


Figure 2-4 Connect DG900 and the Spectrum Analyzer

2. Turn on DG900. Press **Preset** and tap the **Def** icon, then a dialog box is displayed, tap **"Apply"** to restore DG900 to the factory setting.

3. Set DG900:
   a) Set the output impedance of CH1 to 50Ω.((Tap the channel output configuration status bar  under the user interface to enter the channel setting interface. Tap the **OutputSet** → **HighZ** to select "Off". Tap the **Impedance** menu label, and set the impedance to 50Ω.)
   b) Set the output waveform of CH1 to a sine waveform with 10MHz frequency, 0dBm amplitude and $0V_{dc}$ offset.
   c) Press **Output1** or tap the channel output configuration status bar  to turn on the output of CH1 in the channel setting interface.

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

6. Keep the output impedance of CH1 of DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 20MHz 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 10MHz and stop frequency to 60MHz.

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

9. Keep the output impedance of CH1 of DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 40MHz 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 30MHz and stop frequency to 130MHz.

11. Use the marker function to make measurements and record the measurement values of the base waveform and 2nd order harmonic. Calculate[2] the harmonic distortion and judge whether it is less than -40dBc.

12. Keep the output impedance of CH1 of DG900 at 50Ω. Set the output waveform of CH1 as a sine waveform with 60MHz frequency, 0dBm amplitude and 0V_{dc} offset.

13. 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.

14. Use the marker function to make measurements and record the measurement values of the base waveform and 2nd order harmonic. Calculate[2] the harmonic distortion and judge whether it is less than -35dBc.

15. Repeat steps 1 to 14 to test the harmonic distortion of CH2 and record the test results.

Note[2]: 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 -56.2dBm, the 2nd order harmonic distortion = (-56.2) -0.8=-57dBc<-55dBc and the test result fulfills the specification requirement.

Test Record Form

Frequency Setting Value	Setting	Measurement Value	Calculation Result[3]	Specification	Pass/Fail
10MHz	Waveform: Sine Amplitude: 0dBm Offset: $0V_{dc}$	Base waveform:		<-55dBc	
		2nd order harmonic:			
20MHz		Base waveform:		<-50dBc	
		2nd order harmonic:			
40MHz		Base waveform:		<-40dBc	
		2nd order harmonic:			
60MHz		Base waveform:		<-35dBc	
		2nd order harmonic:			

Note[3]: Calculation result = 2th order harmonic measurement value - base waveform measurement value.

Spurious Signal Test

Specification

Sine Wave Spectrum Purity	
Spurious signal (non-harmonic)	Typical[1] ≤10 MHz: <-60 dBc >10 MHz: <-60 dBc + 6 dB/octave[2]

Note[1]: 0 dBm output, DC offset 0, impedance 50 Ω.
Note[1]: 6 dBc/octave means that when the frequency doubles, the specification increases by 6 dBc. For example, when the output frequency of DG900 is 10MHz, the specification is <-60dBc and when the output frequency is 30MHz, the specification is <-60dBc+2×6dBc, namely <-48dBc.

Test Procedures

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG900 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 DG900 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 DG900. Press **Preset** and tap the **Def** icon, then a dialog box is displayed, tap **"Apply"** to restore DG900 to the factory setting.

3. Set DG900:
   a) Set the output impedance of CH1 to 50Ω. (Tap the channel output configuration status bar  under the user interface to enter the channel setting interface. Tap the **OutputSet** → **HighZ** to select "Off". Tap the **Impedance** menu label, and set the impedance to 50Ω.)
   b) Set the output waveform of CH1 to a sine waveform with 5MHz frequency, 0dBm amplitude and $0V_{dc}$ offset.
   d) Press **Output1** or tap the channel output configuration status bar  to turn on the output of CH1 in the channel setting interface.

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 marker 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 DG900 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 0Hz 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 marker 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 DG900 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 0Hz and stop frequency to 100MHz.

12. Repeat steps 8 and 9.

13. Keep the output impedance of CH1 of DG900 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 0Hz and stop frequency to 150MHz.

15. Repeat steps 8 and 9.

16. Keep the output impedance of CH1 of DG900 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 0Hz 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			<-60dBc		
10MHz	0Hz	50MHz			<-60dBc		
20MHz	0Hz	100MHz			<-54dBc		
30MHz	0Hz	150MHz			<-48dBc		
60MHz	0Hz	300MHz			<-30dBc		

Rise/Fall Time Test

Specification

Signal Characteristic	
Square	
Rise/Fall Time	Typical (1 Vpp, 1 kHz) ≤9 ns

Test Procedures

1. Make sure that the environment temperature is between 18℃ and 28℃ and DG900 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 DG900 with the signal input terminal of the oscilloscope using a dual-BNC connecting cable as shown in Figure 2-5.

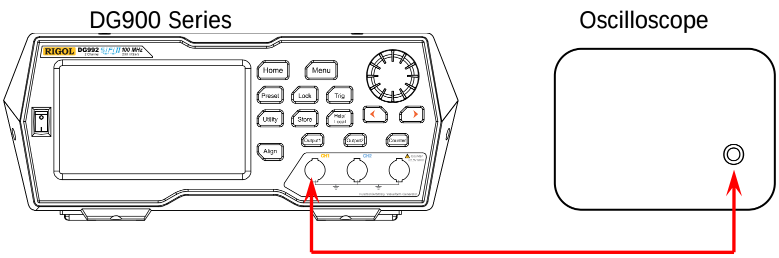
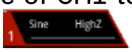


Figure 2-5 Connect DG900 and the Oscilloscope

2. Turn on DG900. Press **Preset** and tap the **Def** icon, then a dialog box is displayed, tap **"Apply"** to restore DG900 to the factory setting.

3. Set DG900:
   a) Set the output impedance of CH1 to 50Ω. (Tap the channel output configuration status bar  under the user interface to enter the channel setting interface. Tap the **OutputSet** → **HighZ** to select "Off". Tap the **Impedance** menu label, and set the impedance to 50Ω.)
   b) Set the output waveform of CH1 to a square waveform with 1kHz frequency, 1Vpp amplitude and $0V_{dc}$ offset.
   c) Press **Output1** or tap the channel output configuration status bar  to turn on the output of CH1 in the channel setting interface.

4. Turn on and set the oscilloscope:
   a) Set the vertical scale to 200mV/div.
   b) Set the horizontal time base to 1us.

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

<table>
<tr><th>Waveform</th><th>Setting</th><th colspan="2">Measurement Value</th><th>Specification</th><th colspan="2">Pass/Fail</th></tr>
<tr><td rowspan="2">Square</td><td rowspan="2">Frequency: 1kHz
Amplitude: 1Vpp
Offset: 0V$_{dc}$</td><td>Rise Time</td><td></td><td rowspan="2">Typical (1 Vpp, 1 kHz)
≤9 ns</td><td></td><td rowspan="2"></td></tr>
<tr><td>Fall Time</td><td></td><td></td></tr>
</table>

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 DG900 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 DG900 with the signal input terminal of the oscilloscope using a dual-BNC connecting cable as shown in Figure 2-5.

2. Turn on DG900. Press **Preset** and tap the **Def** icon, then a dialog box is displayed, tap **"Apply"** to restore DG900 to the factory setting.

3. Set DG900:
   a) Set the output impedance of CH1 to 50Ω. (Tap the channel output configuration status bar 

 under the user interface to enter the channel setting interface. Tap the **OutputSet** → **HighZ** to select "Off". Tap the **Impedance** menu label, and set the impedance to 50Ω.)
   b) Set the output waveform of CH1 to a square waveform with 100kHz frequency, 1Vpp amplitude and $0V_{dc}$ offset.
   c) Press **Output1** or tap the channel output configuration status bar 

 to turn on the output of CH1 in the channel setting interface.

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 DG900 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		0.999 998 999 999 999 99MHz to 1.000 001 000 000 000 01MHz		
Square					
Ramp					
Pulse					

AC Amplitude Accuracy Test

Amplitude Setting Value	Setting	Measurement Value	Specification	Pass/Fail	
20mVpp	Frequency: 1kHz Offset: $0V_{dc}$ Impedance: 50Ω		5.2mVrms to 8.9mVrms		
100mVpp			33.2mVrms to 37.5mVrms		
500mVpp			173.3mVrms to 180.3mVrms		
1Vpp			348.3mVrms to 358.9mVrms		
5Vpp			1.75Vrms to 1.7875Vrms		
10Vpp			3.5Vrms to 3.5732Vrms		

DC Offset Accuracy Test

Offset Setting Value	Setting	Measurement Value	Specification	Pass/Fail
-2.5V_{dc}	Frequency: 1kHz Amplitude: 5Vpp Impedance: 50Ω		-2.530V_{dc} to -2.470V_{dc}	
-1V_{dc}			-1.045V_{dc} to -0.955V_{dc}	
-500mV_{dc}			-0.550V_{dc} to -0.450V_{dc}	
0V_{dc}			-0.055V_{dc} to 0.055V_{dc}	
500mV_{dc}			0.440V_{dc} to 0.560V_{dc}	
1V_{dc}			0.935V_{dc} to 1.065V_{dc}	
2.5V_{dc}			2.420V_{dc} to 2.580V_{dc}	

AC Flatness Test

Frequency Setting Value	Setting	Measurement Value	Calculation Result[1]	Specification	Pass/Fail
5MHz	Amplitude: 1Vpp Impedance: 50Ω			±0.1dB	
10MHz				±0.2dB	
15MHz				±0.2dB	
20MHz				±0.3dB	
25MHz				±0.3dB	
30MHz				±0.5dB	
40MHz				±0.5dB	
50MHz				±1dB	

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

Harmonic Distortion Test

Frequency Setting Value	Setting	Measurement Value	Calculation Result[1]	Specification	Pass/Fail	
10MHz	Waveform: Sine Amplitude: 0dBm Offset: $0V_{dc}$	Base waveform:		<-55dBc		
		2nd order harmonic:				
20MHz		Base waveform:		<-50dBc		
		2nd order harmonic:				
40MHz		Base waveform:		<-40dBc		
		2nd order harmonic:				
60MHz[2]		Base waveform:		<-35dBc		
		2nd order harmonic:				

Note[1]: Calculation result = 2th order harmonic measurement value - base waveform measurement value.
Note[2]: Only applicable to DG992 and DG972.

Spurious Signal Test

Output Frequency	Start Frequency	Stop Frequency	A	A-0dBm	Specification	Pass/Fail	
5MHz	0Hz	30MHz			<-60dBc		
10MHz	0Hz	50MHz			<-60dBc		
20MHz	0Hz	100MHz			<-54dBc		
30MHz	0Hz	150MHz			<-48dBc		
60MHz[1]	0Hz	300MHz			<-30dBc		

Note[1]: Only applicable to DG992 and DG972.

Rise/Fall Time Test

Waveform	Setting	Measurement Value		Specification	Pass/Fail	
Square	Frequency: 1kHz Amplitude: 1Vpp Offset: $0V_{dc}$	Rise Time		Typical (1 Vpp, 1 kHz) ≤9 ns		
		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		0.999 998 999 999 999 99MHz to 1.000 001 000 000 000 01MHz		
Square					
Ramp					
Pulse					

AC Amplitude Accuracy Test

Amplitude Setting Value	Setting	Measurement Value	Specification	Pass/Fail	
20mVpp	Frequency: 1kHz Offset: 0V_{dc} Impedance: 50Ω		5.2mVrms to 8.9mVrms		
100mVpp			33.2mVrms to 37.5mVrms		
500mVpp			173.3mVrms to 180.3mVrms		
1Vpp			348.3mVrms to 358.9mVrms		
5Vpp			1.75Vrms to 1.7875Vrms		
10Vpp			3.5Vrms to 3.5732Vrms		

DC Offset Accuracy Test

Offset Setting Value	Setting	Measurement Value	Specification	Pass/Fail	
-2.5V_{dc}	Frequency: 1kHz Amplitude: 5Vpp Impedance: 50Ω		-2.530V_{dc} to -2.470V_{dc}		
-1V_{dc}			-1.045V_{dc} to -0.955V_{dc}		
-500mV_{dc}			-0.550V_{dc} to -0.450V_{dc}		
0V_{dc}			-0.055V_{dc} to 0.055V_{dc}		
500mV_{dc}			0.440V_{dc} to 0.560V_{dc}		
1V_{dc}			0.935V_{dc} to 1.065V_{dc}		
2.5V_{dc}			2.420V_{dc} to 2.580V_{dc}		

AC Flatness Test

Frequency Setting Value	Setting	Measurement Value	Calculation Result[1]	Specification	Pass/Fail
5MHz	Amplitude: 1Vpp Impedance: 50Ω			±0.1dB	
10MHz				±0.2dB	
15MHz				±0.2dB	
20MHz				±0.3dB	
25MHz				±0.3dB	
30MHz				±0.5dB	
40MHz				±0.5dB	
50MHz				±1dB	

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

Harmonic Distortion Test

Frequency Setting Value	Setting	Measurement Value	Calculation Result[1]	Specification	Pass/Fail
10MHz	Waveform: Sine Amplitude: 0dBm Offset: $0V_{dc}$	Base waveform:		<-55dBc	
		2nd order harmonic:			
20MHz		Base waveform:		<-50dBc	
		2nd order harmonic:			
40MHz		Base waveform:		<-40dBc	
		2nd order harmonic:			
60MHz[2]		Base waveform:		<-35dBc	
		2nd order harmonic:			

Note[1]: Calculation result = 2th order harmonic measurement value - base waveform measurement value.
Note[2]: Only applicable to DG992 and DG972.

Spurious Signal Test

Output Frequency	Start Frequency	Stop Frequency	A	A-0dBm	Specification	Pass/Fail	
5MHz	0Hz	30MHz			<-60dBc		
10MHz	0Hz	50MHz			<-60dBc		
20MHz	0Hz	100MHz			<-54dBc		
30MHz	0Hz	150MHz			<-48dBc		
60MHz[1]	0Hz	300MHz			<-30dBc		

Note[1]: Only applicable to DG992 and DG972.

Rise/Fall Time Test

Waveform	Setting	Measurement Value		Specification	Pass/Fail	
Square	Frequency: 1kHz Amplitude: 1Vpp Offset: $0V_{dc}$	Rise Time		Typical (1 Vpp, 1 kHz) ≤9 ns		
		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 when the following two conditions are met.

- The signal generator is within the calibration period.
- The signal generator has been running ceaselessly for over 30 minutes under the specified operating temperature (23℃±5℃).

All the specifications are guaranteed except the parameters marked with "Typical".

Model	**DG952**	**DG972**	**DG992**
Channel	2	2	2
Max. Frequency	50 MHz	70 MHz	100 MHz
Sample Rate	250 MSa/s		
Waveform			
Basic Waveforms	Sine, Square, Ramp, Pulse, Noise, DC, Dual-tone		
Advanced Waveforms	PRBS, RS232, Sequence		
Built-in Arbitrary Waveforms	160 types of waveforms, including Sinc, Exponential Rise, Exponential Fall, ECG, Gauss, HaverSine, Lorentz, etc.		
Frequency Characteristics			
Sine	1 μHz to 50 MHz	1 μHz to 70 MHz	1 μHz to 100 MHz
Square	1 μHz to 15 MHz	1 μHz to 20 MHz	1 μHz to 25 MHz
Ramp	1 μHz to 1.5 MHz	1 μHz to 1.5 MHz	1 μHz to 2 MHz
Pulse	1 μHz to 15 MHz	1 μHz to 20 MHz	1 μHz to 25 MHz
Harmonic	1 μHz to 20 MHz	1 μHz to 20 MHz	1 μHz to 25 MHz
PRBS	2 kbps to 40 Mbps	2 kbps to 50 Mbps	2 kbps to 60 Mbps
Dual-tone	1 μHz to 20 MHz	1 μHz to 20 MHz	1 μHz to 20 MHz
RS232	baud rate range: 9600, 14400, 19200, 38400, 57600, 115200, 128000, 230400		
Sequence	2 k to 60 MSa/s		
Noise (-3 dB)	100 MHz bandwidth		
Arbitrary Waveform	1 μHz to 15 MHz	1 μHz to 20 MHz	1 μHz to 20 MHz
Resolution	1 μHz		
Accuracy	±(1 ppm of the setting value + 10 pHz), 18℃ to 28℃		
Sine Wave Spectrum Purity			
Harmonic Distortion	Typical[1] DC to 10 MHz (included): <-55 dBc 10 MHz to 20 MHz (included): <-50 dBc 20 MHz to 40 MHz (included): <-40 dBc >40 MHz: <-35 dBc		
Total Harmonic Distortion[1]	<0.075% (10 Hz to 20 kHz)		
Spurious (non-harmonic)	Typical[1] ≤10 MHz: <-60 dBc >10 MHz: <-60 dBc + 6 dB/octave		
Phase Noise	Typical (0 dBm, 10 kHz offset)		

	10 MHz: <-105 dBc/Hz
Signal Characteristics	
Square	
Rise/Fall Time	Typical (1 Vpp, 1 kHz) ≤9 ns
Overshoot	Typical (100 kHz, 1 Vpp) ≤5%
Duty	0.01% to 99.99% (limited by the current frequency setting)
Non-symmetry	1% of the period + 4 ns
Jitter (rms)	Typical (1 Vpp) ≤5 MHz: 2 ppm of the period + 200 ps >5 MHz: 200 ps
Ramp	
Linearity	≤1% of peak output (typical, 1 kHz, 1 VPP, 100% symmetry)
Symmetry	0% to 100%
Pulse	
Pulse	16 ns to 1000 ks (limited by the current frequency setting)
Duty	0.001% to 99.999% (limited by the current frequency setting)
Rising/Falling Edge	≥8 ns (limited by the current frequency setting and pulse width setting)
Overshoot	Typical (1 Vpp, 1 kHz) ≤5%
Jitter (rms)	Typical (1 Vpp) ≤5 MHz: 2 ppm of the period + 200 ps >5 MHz: 200 ps
Arbitrary Waveform Sequence	
Waveform Length	16 Mpts
Vertical Resolution	16 bits
Sample Rate	Interpolation filter: 10 Sa/s to 60 MSa/s Step filter: 2k Sa/s to 50 MSa/s Smooth filter: 2k Sa/s to 50 MSa/s
Min Rise/Fall Time	Interpolation filter: ≥8 ns Step filter: 3.0/sample rate Smooth filter: 1.0/sample rate
Jitter (rms)	Typical (1 Vpp) Interpolation filter: 200 ps Step filter: <5 ps Smooth filter: <5 ps
Overshoot	Typical (1 Vpp) ≤5%
Harmonic Output	
Harmonic Order	≤8
Harmonic Type	Even Harmonic, Odd Harmonic, Order Harmonic, User
Harmonic Amplitude	The amplitude of each order of the harmonic can be set.
Harmonic Phase	The phase of each order of harmonic can be set.
Output Characteristics	
Amplitude (into 50 Ω)	
Range	≤10 MHz: 1.0 mVpp to 10 Vpp ≤30 MHz: 1.0 mVpp to 5.0 Vpp ≤60 MHz: 1.0 mVpp to 2.5 Vpp >60 MHz: 1.0 mVpp to 1 Vpp

Accuracy	Typical (1 kHz sine, 0 V offset, >10 mVpp, auto) ±(1% of the setting value) ± 5 mV
Flatness	Typical (Sine, 1 Vpp) ≤5 MHz: ±0.1 dB ≤15 MHz: ±0.2 dB ≤25 MHz: ±0.3 dB ≤40MHz: ±0.5 dB >40 MHz: ±1 dB
Unit	Vpp, Vrms, dBm
Resolution	0.1 mVpp or 4 digits
Offset (into 50 Ω)	
Range (Peak ac+dc)	±5 Vpk ac+dc
Accuracy	±(1% of the setting value + 5 mV + 1% of the amplitude)
Waveform Output	
Output Impedance	50 Ω (typical)
Protection	Short-circuit protection, automatically disable the waveform output when overload occurs
Modulation Characteristics	
Modulation Type	AM, FM, PM, ASK, FSK, PSK, PWM
AM	
Carrier Waveform	Sine, Square, Ramp, Arb
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Modulation Depth	0% to 120%
Modulation Frequency	2 mHz to 1 MHz
FM	
Carrier Waveform	Sine, Square, Ramp, Arb
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Modulation Frequency	2 mHz to 1 MHz
PM	
Carrier Waveform	Sine, Square, Ramp, Arb
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Phase Deviation	0° to 360°
Modulation Frequency	2 mHz to 1 MHz
ASK	
Carrier Waveform	Sine, Square, Ramp, Arb
Source	Internal/External
Modulating Waveform	Square with 50% duty cycle
Key Frequency	2 mHz to 1 MHz
FSK	
Carrier Waveform	Sine, Square, Ramp, Arb
Source	Internal/External

Modulating Waveform	Square with 50% duty cycle		
Key Frequency	2 mHz to 1 MHz		
PSK			
Carrier Waveform	Sine, Square, Ramp, Arb		
Source	Internal/External		
Modulating Waveform	Square with 50% duty cycle		
Key Frequency	2 mHz to 1 MHz		
PWM			
Carrier Waveform	Pulse		
Source	Internal/External		
Modulating Waveform	Sine, Square, Ramp, Noise, Arb		
Width Deviation	0% to 100% of the pulse width		
Modulation Frequency	2 mHz to 1 MHz		
External Modulation Input			
Input Range	AM, PM, FM: 75 mVRMS to ±5 (Vac+dc) ASK, PSK, FSK: standard 5 V TTL		
Input Bandwidth	50 kHz		
Input Impedance	10 kΩ		
Burst Characteristics			
Carrier Waveform	Sine, Square, Ramp, Pulse, Noise, Arb, PRBS, RS232, Sequence (except DC, dual-tone, and Harmonic)		
Carrier Frequency	2 mHz to 50 MHz	2 mHz to 70 MHz	2 mHz to 100 MHz
Burst Count	1 to 1,000,000 or Infinite		
Internal Period	1 μs to 500 s		
Gated Source	External Trigger		
Source	Internal, External, Manual		
Trigger Delay	0 ns to 100 s		
Sweep Characteristics			
Carrier Waveform	Sine, Square, Ramp, Arb		
Type	Linear, Log, and Step		
Orientation	Up/Down		
Start/Stop Frequency	Same as the upper/lower limit of the corresponding carrier frequency		
Sweep Time	1 ms to 500 s		
Hold/Return Time	0 ms to 500 s		
Source	Internal, External, Manual		
Marker	Falling edge of the sync signal (programmable)		
Frequency Counter			
Measurement Function	Frequency, Period, Positive/Negative Pulse Width, Duty Cycle		
Frequency Resolution	7 digits/s (Gate Time = 1 s)		
Frequency Range	1 μHz to 240 MHz		

Period Measurement	Measurement Range	4 ns to 1,000 ks	
Voltage Range and Sensitivity (non-modulating signal)			
DC Coupling	DC Offset Range	±1.5 Vdc	
	1 μHz to 100 MHz	50 mVRMS to ±2.5 (Vac+dc)	
	100 MHz to 240 MHz	100 mVRMS to ±2.5 (Vac+dc)	
AC Coupling	1 μHz to 100 MHz	50 mVRMS to ±2.5 Vpp	
	100 MHz to 240 MHz	100 mVRMS to ±2.5 Vpp	
Pulse Width and Duty Cycle Measurement			
Frequency and Amplitude Ranges	1 μHz to 25 MHz	50 mVRMS to ±2.5 (Vac+dc)	DC Coupling
Pulse Width	Min. Pulse Width	≥20 ns	
	Pulse Width Resolution	5 ns	
Duty	Measurement Range (display)	0% to 100%	
Input Characteristics			
Input Signal Range	Breakdown Voltage	±7 (Vac+dc)	Input Impedance = 1 MΩ
Input Adjustment	Coupling Mode	AC	DC
	High Frequency Rejection	On: Input Bandwidth = 150 kHz; Off: Input Bandwidth = 240 MHz	
Input Trigger	Trigger Level Range	-2.5 V to +2.5 V	
	Trigger Sensitivity Range	High, Low	
GateTime	1 ms	1.048 ms	
	10 ms	8.389 ms	
	100 ms	134.218 ms	
	1 s	1.074 s	
	10 s	8.590 s	
	>10 s	>8.590 s	

Trigger Characteristics	
Trig Input	
Level	TTL-compatible
Slope	Rising or falling (selectable)
Pulse Width	>100 ns
Latency	Sweep: <100 ns (typical) Burst: <350 ns (typical)
Trigger Output	

Level	TTL-compatible
Pulse Width	>60 ns (typical)
Max. Frequency	1 MHz
Two-channel Characteristics - Phase Offset	
Range	0° to 360°
Waveform Phase Resolution	0.03°
Reference Clock	
External Reference Input	
Lock Range	10 MHz ± 50 Hz
Level	250 mVpp to 5 Vpp
Lock Time	<2 s
Input Impedance (Typical)	1 kΩ, AC coupling
Internal Reference Output	
Frequency	10 MHz ± 50 Hz
Level	3.3 Vpp
Output Impedance (Typical)	50 Ω, AC coupling
Synchronous Output	
Level	TTL-compatible
Impedance	50 Ω, nominal value
Overvoltage Protection	
Occurred when: ● The instrument amplitude setting is greater than 3.2 Vpp or the output AC+DC is greater than |1.6 V_{DC}| and the input voltage is greater than ±12 × (1 ± 5%)V (<10 kHz). Disruptive discharge voltage: ±18(Vac + dc). ● The instrument amplitude setting is smaller than or equal to 3.2 Vpp or the output AC+DC is smaller than |1.6 V_{DC}| and the input voltage is greater than ±2.6 × (1 ± 5%)V (<10 kHz). Disruptive discharge voltage: ±5(Vac + dc).	
Overcurrent Protection	
Occurred when: the current is greater than ±240 mA.	
Programming Time	
Configuration Changes	USB
Function Change	10 ms
Amplitude Change	5 ms
Frequency Change	5 ms
General Specifications	
Power Supply	
Power Voltage	100 V to 127 V (45 Hz to 440 Hz) 100 V to 240 V (45 Hz to 65Hz)
Power Consumption	Lower than 30 W
Display	

Type	4.3-inch TFT LCD touch screen	
Resolution	480 horizontal × RGB × 272 vertical resolution	
Color	16 M	
Environment		
Temperature Range	Operating: 0℃ to 45℃ Non-operating: -40℃ to 60℃	
Cooling Method	Natural air cooling	
Humidity Range	Below 30℃: ≤95%RH 30℃ to 40℃: ≤75%RH 40℃ to 50℃: ≤45%RH	
Altitude	Operating: below 3,000 meters Non-operating: below 15,000 meters	
Mechanical Characteristics		
Dimensions (W×H×D)	237.4 mm × 97 mm × 268 mm	
Weight	Package excluded: 1.75 kg Package included: 2.85 kg	
Interface	USB Host, USB Device, and USB-GPIB	
IP Protection	IP2X	
Calibration Interval	1 year (recommended)	
Certification Information		
EMC	Compliant with EN61326-1:2006	
	IEC 61000-3-2:2000	±4.0 kV (Contact Discharge) ±4.0 kV (Air Discharge)
	IEC 61000-4-3:2002	3 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)
	IEC 61000-4-4:2004	1kV power line
	IEC 61000-4-5:2001	0.5 kV (phase-to-neutral voltage); 0.5 kV (phase-to-earth voltage); 1 kV (neutral-to-earth voltage)
	IEC 61000-4-6:2003	3 V, 0.15 MHz to 80 MHz
	IEC 61000-4-11:2004	Voltage dip: 0% UT during half cycle 0% UT during 1 cycle 70% UT during 25 cycles Short interruption: 0% UT during 1 cycle
Electrical Safety	complies with USA: UL 61010-1:2012, Canada: CAN/CSA-C22.2 No. 61010-1-2012 EN 61010-1:2010,	

Note[1]: 0 dBm output, DC offset 0, impedance 50 Ω.