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DS80000 Series

Digital Oscilloscope

Performance Verification Guide

Apr. 2024

Guaranty and Declaration

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1 Safety Requirement

1.1 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 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, 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.
- **Proper Use of Battery.**

Do not expose the battery (if available) to high temperature or fire. Keep it out of the reach of children. Improper change of battery (note: lithium battery) may cause explosion. Use the RIGOL specified battery only.
- **Handle with Caution.**

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

1.2 Safety Notices and Symbols

Safety Notices in this Manual:



WARNING

Indicates a potentially hazardous situation or practice which, if not avoided, will result in serious injury or death.



CAUTION

Indicates a potentially hazardous situation or practice which, if not avoided, could result in damage to the product or loss of important data.

Safety Notices on the Product:

- **DANGER**

It calls attention to an operation, if not correctly performed, could result in injury or hazard immediately.

- **WARNING**

It calls attention to an operation, if not correctly performed, could result in potential injury or hazard.

- **CAUTION**

It calls attention to an operation, if not correctly performed, could result in damage to the product or other devices connected to the product.

Safety Symbols on the Product:



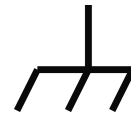
Hazardous Voltage



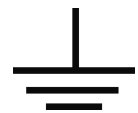
Safety Warning



Protective Earth Terminal



Chassis Ground



Test Ground

2 Specifications

This chapter lists the technical specifications of the DS80000 series oscilloscope.

The maximum sample rate of DS80000 series digital oscilloscope is 40 GSa/s, the highest bandwidth is 13 GHz. RIGOL's brand new self-developed core module guarantees the specifications to reach the advanced level in the industry, with up to 4 Gpts memory depth and 8-16 bits adjustable resolution.

To ensure that the instrument performance meets the specifications, the instrument shall meet the following requirements.

- The instrument has been calibrated in an ambient temperature between 18°C and 28°C.
- The instrument is required to be operating within the specified environmental limits. For specific environment requirements, please refer to *DS80000 Data Sheet*.
- The instrument must be powered from a source that meets the requirement. For the power specification, refer to *DS80000 Data Sheet*.
- The instrument shall have a warm-up of at least 30 minutes within the specified operating temperature range.

The following table shows some of the technical specifications of DS80804 and DS81304. For other technical specifications of DS80000, please refer to *DS80000 Data Sheet*.

Table 2.1 Specifications

Overview of the DS80000 Series Technical Specifications		
Model	DS80804	DS81304
No. of Input Channels	4 analog channel inputs 1 EXT channel input	
Input Coupling	DC ^[1]	
Input Impedance	50 Ω ± 3%	
Max. Analog Bandwidth	8 GHz ^[2]	13 GHz ^[2]
BW Limit	500 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz, 5 GHz, 6 GHz, and 7 GHz	500 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz, 5 GHz, 6 GHz, 7 GHz, 8 GHz, 9 GHz, 10 GHz, 11 GHz, and 12 GHz

Overview of the DS80000 Series Technical Specifications

Sampling Mode	Real-time Sampling
Max. Analog Channel Sample Rate	40 GSa/s ^[2]
Max. Memory Depth	Standard: 500 Mpts Option: 4 Gpts ^[2]
Max. Waveform Capture Rate	>500,000 wfms/s
Vertical Resolution	8-16 bits (selectable)
DC Gain Accuracy ^[3]	± 2% Full Scale
Timebase Accuracy	±0.2 ppm ± 1 ppm/year
Trigger Source	Analog channel (1 to 4), EXT TRIG

NOTE

[1]: Only DC is available for input coupling under the input impedance of 50 Ω.

[2]: CH1, CH2, CH3, and CH4 are independent of each other. Whatever one or multiple channels are enabled, the maximum specifications of the instrument can be reached.

[3]: 1 mV/div and 2 mV/div are a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 1 mV/div and 2 mV/div sensitivity setting.

3 Document Overview

This manual is designed to guide you to properly test the performance specifications of RIGOL DS80000 series digital oscilloscope. For the operation methods mentioned in the test procedures, refer to User Guide of this product.



TIP

For the latest version of this manual, download it from the official website of RIGOL (<http://www.rigol.com>).

Publication Number


PVA38100-1110

Software Version

Software upgrade might change or add product features. Please acquire the latest version of the manual from RIGOL website or contact RIGOL to upgrade the software.

Format Conventions in this Manual


1. Key


The front panel key is denoted by the menu key icon. For example,  indicates the "Default" key.

2. Menu

The menu item is denoted by the format of "Menu Name (Bold) + Character Shading" in the manual. For example, **Setup** indicates clicking or tapping the "Setup" sub-menu under the "Utility" function menu to view the basic setting configuration items.

3. Operation Procedures

The next step of the operation is denoted by ">" in the manual. For example, 

> **Storage** indicates that first clicking or tapping the icon , then clicking or tapping **Storage**.

4. Connector

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

Content Conventions in this Manual

DS80000 series includes the following models. Unless otherwise specified, this manual takes DS81304 as an example to illustrate the methods for the performance verification of DS80000 series.

Model	Max. Analog Bandwidth	No. of Analog Channels	Sample Rate
DS81304	13 GHz	4	Full-channel ^[1] : 40 GSa/s
DS80804	8 GHz	4	Full-channel ^[1] : 40 GSa/s

**NOTE**

[1]: Whatever one or multiple channels are enabled, the maximum specifications of the instrument can be reached.



4 Overview

4.1 To Prepare for the Test

Before the test, make the following preparations.

1. Self-test
2. Warm-up (make sure that the instrument has been running for at least 30 minutes)
3. Self-calibration

Self-test

After the instrument is connected to the power source, press the power key  at the lower-left corner of the front panel to power on the instrument. (You can also click or tap  > **Utility** > **Setup**. Then select "Switch On" for the **Power status** menu. After the instrument is connected to power source, it will start directly).

During the start-up process, the instrument performs a series of self-tests. After the self-test, the splash screen is displayed.

If the oscilloscope cannot start normally, refer to "Troubleshooting" section in *DS80000 User Guide* to locate the problem and resolve it. Do not perform self-calibration or performance verification tests until the instrument passes the self-test.

Self-calibration

The self-calibration program can quickly make the oscilloscope to work in an optimal state to get the precise measurement results. You can perform self-calibration at any time, especially when the changes of the ambient temperature reach or above 5°C. Make sure that the oscilloscope has been warmed up or operating for more than 30 minutes before the self-calibration.

1. Disconnect all the input channels.
2. In "Utility" menu, click or tap **SelfCal**, the following self-calibration interface is shown below.

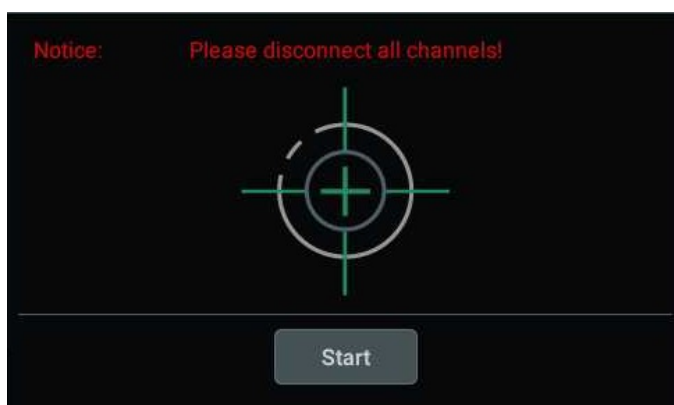


Figure 4.1 Self-calibration Menu

- Click or tap **Start**, and then the oscilloscope will start to execute the self-calibration program.
 - After starting the self-calibration program, click you can or tap **Exit** to cancel self-calibration operation at any time.
3. After completing the self-calibration, restart the oscilloscope. In the **Horizontal** system menu, select "Average" for the **Acquisition** menu. Then click or tap the input field for the **Averages** menu item to set it by using the pop-up numeric keypad. Set the number of averages to 16.
 4. Set the vertical scale of each channel to 2 mV/div and view the offset of the waveform of each channel. If the offset is greater than 0.5 div, check whether there are interference signals around you and whether the power source is well grounded. If yes, perform self-calibration again.
 5. Click or tap **Close** to close the self-calibration information window.

4.2 Test Result Record

Record and keep the test result of each test. In the final chapter of this manual, a test result record form is provided. The form lists all the test items and their corresponding performance limits as well as spaces for users to record the test results.



TIP

It is recommended that users photocopy the test record form before each test and record the test results in the copy so that the form can be used repeatedly.

4.3 Specifications

The specification of each test item is provided in this manual. For other technical parameters, refer to *DS80000 Data Sheet* (available to download them from RIGOL website: <http://www.rigol.com>).



TIP

All the specifications are only valid when the oscilloscope has been warmed up for more than 30 minutes.

5 Performance Verification Test

This chapter takes DS81304 as an example to illustrate the performance verification test methods and procedures of DS80000 series digital oscilloscope. The recommended test devices in this manual are shown below. You can also use other devices that fulfill the "Specification" in the following table.

Table 5.1 Test Devices

Device	Specification	Recommended Device Model
DC Voltage Source	3 mV to 4 V, $\pm 0.1\%$ accuracy	Fluke 9500B
Signal Generator	9 kHz to 13 GHz	RIGOL DSG5000 Series Microwave Signal Generator (with the OCXO-D08 option)
Power Meter	1 MHz to 13 GHz, $\pm 3\%$ accuracy	-
Power Sensor	1 MHz to 13 GHz, $\pm 3\%$ accuracy	-
Power Splitter	Full-scale accuracy ≤ 0.2 dB	-



TIP

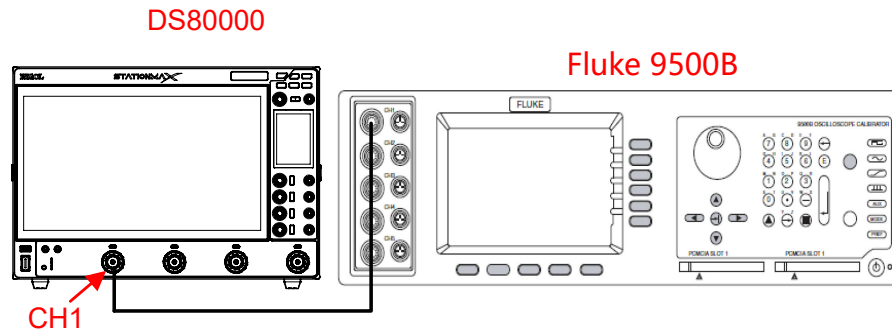
1. Make sure that the oscilloscope passes the self-test and self-calibration is performed before executing the performance verification tests.
2. Make sure that the oscilloscope has been warmed up for at least 30 minutes before executing any of the following tests.
3. Please reset the instrument to the factory setting before or after executing any of the following tests.

5.1 Impedance Test

5.1.1 Specification

Input Impedance	
Analog Channel	50 Ω : 48.5 Ω to 51.5 Ω

5.1.2 Test Connection Diagram




5.1.3 Test Procedures



WARNING

Before connecting, disconnecting, or moving the test devices, disable the output of the signal generator to avoid causing the dangerous voltage.

1. Connect the active head of Fluke 9500B to CH1 of the oscilloscope, as shown in the figure above.
2. Configure the oscilloscope:
 - a. To enable the channel, perform any of the following operations:
 - Click or tap the channel status label at the bottom of the screen to enable the channel.
 - Press the front-panel key  to enable the channel, and the backlight of this key and the corresponding channel key is illuminated.
 - In the **Vertical** menu, select the CH1 tab. Select **ON** for the **Display** menu to turn CH1 on.
 - b. In the **Vertical** system menu, click or tap 50 Ω under **Impedance** to set the input impedance of CH1 to 50 Ω .
 - c. Set the vertical scale of CH1 to 100 mV/div.
3. Turn on Fluke 9500B; set its impedance to 50 Ω and select the resistance measurement function. Read and record the resistance measured.

4. Adjust the vertical scale of CH1 of the oscilloscope to 500 mV/div; read and record the resistance measured.
5. Turn off CH1. Measure the resistances of CH2, CH3, and CH4 respectively using the method above and record the measurement results.

5.1.4 Test Record Form

Channel	Vertical Scale	Test Result	Limit	Pass/Fail
CH1	100 mV/div		48.5 Ω to 51.5 Ω	
	500 mV/div		48.5 Ω to 51.5 Ω	
CH2	100 mV/div		48.5 Ω to 51.5 Ω	
	500 mV/div		48.5 Ω to 51.5 Ω	
CH3	100 mV/div		48.5 Ω to 51.5 Ω	
	500 mV/div		48.5 Ω to 51.5 Ω	
CH4	100 mV/div		48.5 Ω to 51.5 Ω	
	500 mV/div		48.5 Ω to 51.5 Ω	

5.2 DC Gain Accuracy Test

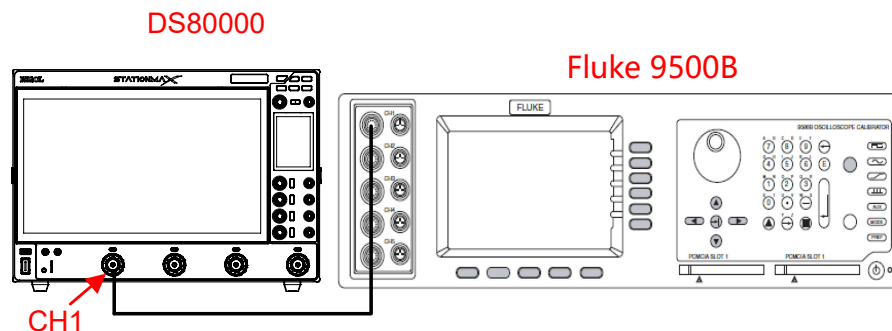
5.2.1 Specification

DC Gain Accuracy	
Specification	$\pm 2\%$ of Full Scale ^[1]

NOTE

[1]: Full scale = 8 \times Current Vertical Scale. 1 mV/div and 2 mV/div are a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 1 mV/div and 2 mV/div vertical sensitivity setting.

5.2.2 Test Connection Diagram



5.2.3 Test Procedures



WARNING

Before connecting, disconnecting, or moving the test devices, disable the output of the signal generator to avoid causing the dangerous voltage.

1. Connect the active head of Fluke 9500B to CH1 of the oscilloscope, as shown in the figure above.
2. Turn on Fluke 9500B; set its impedance to 50 Ω .
3. Output a DC signal with +3 mV_{DC} voltage (Vout1).
4. Configure the oscilloscope:
 - a. Turn on CH1.
 - b. Set the probe attenuation ratio to "1X".
 - c. Set the vertical scale to 1 mV/div.
 - d. Set the horizontal timebase to 1 μ s/div.
 - e. Set the vertical offset to 0.
 - f. In the Horizontal system menu, select "Average" for the **Acquisition** menu. Then click or tap the input field for the **Averages** menu item to set it by using the pop-up numeric keypad. Set the number of averages to 32.
 - g. Adjust the trigger level to avoid that the signals are being triggered by mistake.
5. In the **Measure** menu, click or tap **Vertical** measurement item to select "Vavg". The Vavg measurement result list is displayed at the right section of the screen. Read the value from the "result" list and record the measurement result of Vavg1.
6. Adjust Fluke 9500B to make it output a DC signal with -3 mV_{DC} voltage (Vout1).
7. Enable the average measurement function. Read and record Vavg2.
8. Calculate the relative error of this vertical scale: $\frac{|(Vavg1 - Vavg2) - (Vout1 - Vout2)|}{Full\ Scale} \times 100\%$.
9. Keep the other settings of the oscilloscope unchanged.

- a. Set the vertical scale to 2 mV/div, 5 mV/div, 10 mV/div, 20 mV/div, 50 mV/div, 100 mV/div, 200 mV/div, 500 mV/div and 1 V/div.
 - b. Adjust the output voltage of Fluke 9500B to $3 \times$ the current vertical scale and $-3 \times$ the current vertical scale respectively.
 - c. Repeat Step 3-7 and record the test results.
 - d. Calculate the relative error of each vertical scale: $|(V_{avg1} - V_{avg2}) - (V_{out1} - V_{out2})| / \text{Full Scale} \times 100\%$.
10. Turn off CH1. Test the relative error of each scale of CH2, CH3, and CH4 respectively using the method above and record the test results.

5.2.4 Test Record Form

Channel	Vertical Scale	Test Result			Limit	Pass/Fail
		Vavg1	Vavg2	Calculation Result ^[1]		
CH1	1 mV/div				≤2%	
	2 mV/div				≤2%	
	5 mV/div				≤2%	
	10 mV/div				≤2%	
	20 mV/div				≤2%	
	50 mV/div				≤2%	
	100 mV/div				≤2%	
	200 mV/div				≤2%	
	500 mV/div				≤2%	
	1 V/div				≤2%	
CH2	1 mV/div				≤2%	
	2 mV/div				≤2%	
	5 mV/div				≤2%	
	10 mV/div				≤2%	
	20 mV/div				≤2%	
	50 mV/div				≤2%	
	100 mV/div				≤2%	
	200 mV/div				≤2%	
	500 mV/div				≤2%	
	1 V/div				≤2%	
CH3	1 mV/div				≤2%	
	2 mV/div				≤2%	
	5 mV/div				≤2%	
	10 mV/div				≤2%	

Channel	Vertical Scale	Test Result			Limit	Pass/Fail
		Vavg1	Vavg2	Calculation Result ^[1]		
	20 mV/div				≤2%	
	50 mV/div				≤2%	
	100 mV/div				≤2%	
	200 mV/div				≤2%	
	500 mV/div				≤2%	
	1 V/div				≤2%	
CH4	1 mV/div				≤2%	
	2 mV/div				≤2%	
	5 mV/div				≤2%	
	10 mV/div				≤2%	
	20 mV/div				≤2%	
	50 mV/div				≤2%	
	100 mV/div				≤2%	
	200 mV/div				≤2%	
	500 mV/div				≤2%	
	1 V/div				≤2%	

NOTE

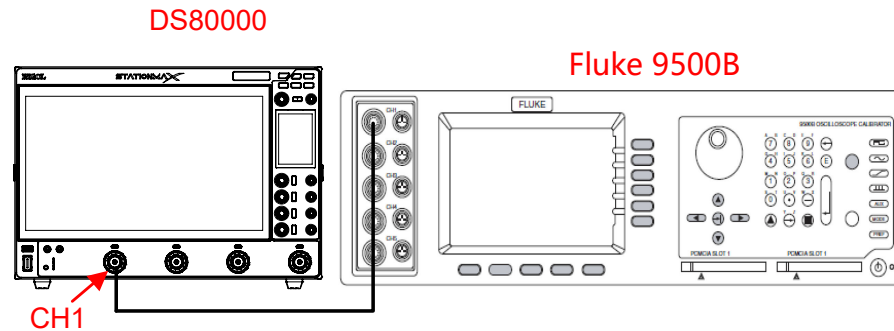
[1]: The calculation formula is $|(V_{avg1} - V_{avg2}) - (V_{out1} - V_{out2})| / \text{Full Scale} \times 100\%$. Wherein, V_{out1} and V_{out2} are 3 x the current vertical scale and -3 x the current vertical scale respectively.

5.3 DC Offset Accuracy Test

5.3.1 Specification

DC Offset Accuracy	
Specification	$\leq 200 \text{ mV/div } (\pm 0.1 \text{ div} \pm 2 \text{ mV} \pm 1.5\% \text{ of the offset value})$ $> 200 \text{ mV/div } (\pm 0.1 \text{ div} \pm 2 \text{ mV} \pm 1.0\% \text{ of the offset value})$

5.3.2 Test Connection Diagram



5.3.3 Test Procedures



WARNING

Before connecting, disconnecting, or moving the test hookup, disable the output of the signal generator to avoid causing the dangerous voltage.

1. Connect the active head of Fluke 9500B to CH1 of the oscilloscope, as shown in the figure above.
2. Set the impedance of Fluke 9500B to 50 Ω .
3. Configure the oscilloscope:

- a. Press Default on the front panel to restore the oscilloscope to the default settings.
- b. Click or tap the drop-down button of the **BW Limit** menu to select "500 M".
- c. Set the vertical scale to 1 mV/div.
- d. Set the offset to 1 V, as shown in the test record form. Close the Vertical system menu.
- e. Adjust the trigger level to avoid that the signals are being triggered by mistake.
- f. Click or tap the horizontal menu ("D" icon) at the top of the screen. Then the **Horizontal** system menu is displayed. In this menu, set the timebase to 1 μ s/div. Select "Average" for the **Acquisition** menu. Then click or tap the input field for the **Averages** menu item to set it by using the pop-up numeric keypad. Set the number of averages item to 16. Close the Horizontal system menu.

4. Set the output of Fluke 9500B to -1 V.
5. In the **Measure** menu, click or tap **Vertical** measurement item to select "Vavg". The Vavg measurement result list is displayed at the right section of the screen. Read the value from the "result" list and record the measurement result.
6. Set the vertical offset of the oscilloscope to 0 V.
7. Set the output of Fluke 9500B to 0 V. Read the value from the "result" list and record the measurement result.
8. Repeat Step 2-7. Measure and record the results according to *Test Record Form*.

5.3.4 Test Record Form

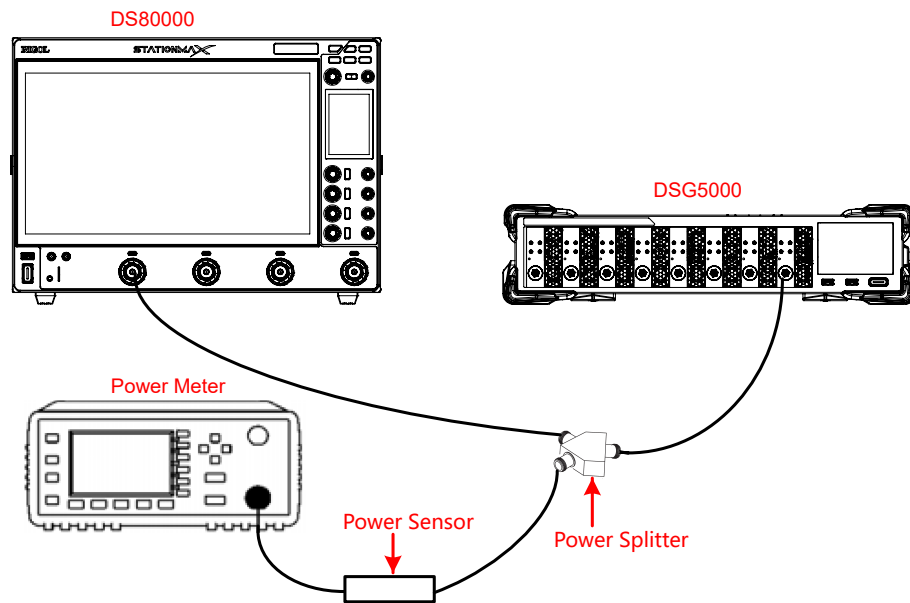
Channel Setting	Vertical Scale	Offset	Test Result	Min. Value	Max. Value
CH1, 500 MHz BW	50 mV/div	0.6 V		-616.000 mV	-584.000 mV
	50 mV/div	0 V		-7.000 mV	7.000 mV
	50 mV/div	-0.6 V		584.000 mV	616.000 mV
	500 mV/div	4 V		-4.092 V	-3.908 V
	500 mV/div	0 V		-52.000 mV	52.000 mV
	500 mV/div	-4 V		3.908 V	4.092 V
CH2, 500 MHz BW	50 mV/div	0.6 V		-616.000 V	-584.000 mV
	50 mV/div	0 V		-7.000 mV	7.000 mV
	50 mV/div	-0.6 V		584.000 mV	616.000 V
	500 mV/div	4 V		-4.092 V	-3.908 V
	500 mV/div	0 V		-52.000 mV	52.000 mV
	500 mV/div	-4 V		3.908 V	4.092 V
CH3, 500 MHz BW	50 mV/div	0.6 V		-616.000 V	-584.000 mV
	50 mV/div	0 V		-7.000 mV	7.000 mV
	50 mV/div	-0.6 V		584.000 mV	616.000 V
	500 mV/div	4 V		-4.092 V	-3.908 V
	500 mV/div	0 V		-52.000 mV	52.000 mV
	500 mV/div	-4 V		3.908 V	4.092 V
CH4, 500 MHz BW	50 mV/div	0.6 V		-616.000 V	-584.000 mV
	50 mV/div	0 V		-7.000 mV	7.000 mV
	50 mV/div	-0.6 V		584.000 mV	616.000 V
	500 mV/div	4 V		-4.092 V	-3.908 V
	500 mV/div	0 V		-52.000 mV	52.000 mV
	500 mV/div	-4 V		3.908 V	4.092 V

5.4 Bandwidth Test

5.4.1 Specification

Model	Bandwidth	Limit
DS81304	13 GHz	-3 dB, all-channel mode
DS80804	8 GHz	-3 dB, all-channel mode

5.4.2 Test Connection Diagram



5.4.3 Test Procedures




WARNING

Before connecting, disconnecting, or moving the test hookup, disable the output of the signal generator to avoid causing the dangerous voltage.

1. The connection diagram is shown in the above figure:

- a. Connect the [RF 50 Ω] connector of DSG5000 to the input of the power splitter by using the N(M)-N(M) cable.
- b. Connect the power meter probe (power sensor) to the output of the power splitter.

- c. Connect the other splitter output to CH1 of the oscilloscope by using the N(M)-BNC(M) cable.
2. Set up the power meter: set the power meter to display measurements in watts.
3. Configure the oscilloscope:
 - a. Press the front-panel key  to enable CH1.
 - b. In the **Vertical** system menu, set the vertical scale to 100 mV/div.
 - c. In the **Horizontal** system menu, set the horizontal timebase to 500 ns/div.
4. Output a Sine with 1 MHz frequency and 6 div amplitude (e.g. 100 mV/div vertical scale, 600 mVpp Sine signal). Adjust the timebase to display five cycles of the waveforms on the screen.
5. In the **Measure** menu, click or tap **Vertical** measurement item to select "AC.RMS". The AC.RMS measurement result list is displayed at the right section of the screen. Read the value from the "result" list and record the measurement result as V_{out_1} MHz.
6. Record the power meter reading $P_{1\text{ MHz}}$ and convert the power to V according to the following formula.

$$V_{in_{1\text{ MHz}}} = \sqrt{P_{1\text{ MHz}} \times 50\Omega}$$

7. Set the signal generator output frequency to the maximum bandwidth frequency of the oscilloscope. For the maximum bandwidth frequency of the oscilloscope, refer to *Specification*.
8. Adjust the horizontal timebase of the oscilloscope.
9. Check the "AC.RMS" result list at the right section of the screen. Read and record the data as $V_{out_{max}}$.
10. Record the power meter reading P_{max} and convert the power to V according to the following formula.

$$V_{in_{max}} = \sqrt{P_{max} \times 50\Omega}$$

11. Calculate the test results by using the formula below:

$$\text{Test Result (dB)} = 20 \lg \left(\frac{V_{\text{out}_{\text{max}}} / V_{\text{in}_{\text{max}}}}{V_{\text{out}_{1\text{MHz}}} / V_{\text{in}_{1\text{MHz}}}} \right)$$

12. The above result should be greater than -3 dB.

13. Repeat Step 3-12 according to the test record form and calculate the test results.

5.4.4 Test Record Form

Model	Limit	CH1	CH2	CH3	CH4
DS80804 (8 GHz)	-3 dB				
DS81304 (13 GHz)	-3 dB				

5.5 Timebase Accuracy Test

5.5.1 Specification

Timebase Accuracy ^[1]	
Specification	$\pm(0.2 \text{ ppm} + 1 \text{ ppm}^{[2]}/\text{year} \times \text{Number of Years that the Instrument Has Been Used}^{[3]})$

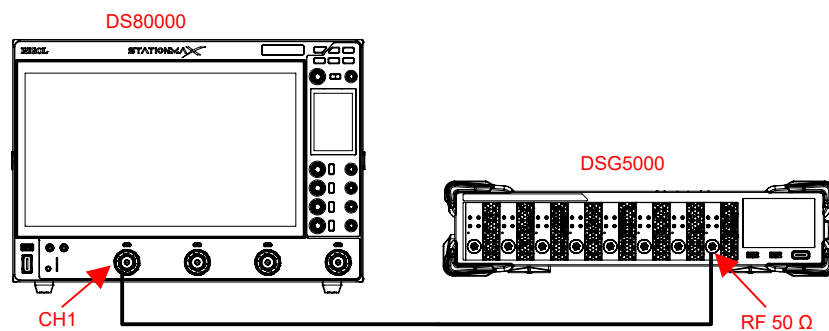
NOTE

[1]: Typical.

[2]: Clock Drift.

[3]: For the number of years that the instrument has been used, please calculate according to the date in the verification certificate provided when the instrument leaves factory.

5.5.2 Test Connection Diagram





5.5.3 Test Procedures



WARNING

Before connecting, disconnecting, or moving the test devices, disable the output of the signal generator to avoid causing the dangerous voltage.

1. Connect the [RF 50Ω] connector of the microwave signal generator DSG5000 (installed with the OCXO-D08 option) to CH1 of the oscilloscope, as shown in the figure above.
2. Output a Sine with 10 MHz frequency and 1 Vpp amplitude via DSG5000.
3. Configure the oscilloscope:
 - a. Press the front-panel key  to enable CH1.
 - b. Click or tap the channel status label of CH1 at the bottom of the screen. Then the **Vertical** menu is displayed. Then click or tap **Probe** to enter the **Probe** setting menu. Set the probe attenuation ratio to "1X".
 - c. Set the vertical scale to 200 mV/div.
 - d. Set the vertical offset to 0 V. Then close the **Vertical** system menu.
 - e. Click or tap the horizontal menu at the top of the screen. Then the **Horizontal** system menu is displayed. In this menu, you can set the horizontal timebase to 1 ns/div.
 - f. Set the horizontal position to 1 ms. Close the **Horizontal** system menu.
 - g. Click or tap the trigger information label at the top of the screen. Set the trigger level to 0 V.
4. Click or tap  > **Cursor**. The "Result" list window is displayed at the right section of the screen. Click or tap the result list window, select **Setting**. Under the **Mode** menu item, select "Manual" to enable the manual mode of cursor measurement. Measure the offset (ΔT) of the middle point of the signal (namely the crossing point of the rising edge of the current signal and the trigger level line)

relative to the screen center using manual cursor measurement and record the measurement result.

5. Calculate the timebase accuracy; namely the ratio of ΔT to the horizontal position of the oscilloscope. For example, if the offset measured is 1 ns, then the timebase accuracy is 1 ns/1 ms=1 ppm.
6. Calculate the timebase accuracy limit by using the formula $\pm(0.2 \text{ ppm} + 1 \text{ ppm}/\text{year} \times \text{Number of Years that the Instrument Has Been Used})$.

5.5.4 Test Record Form

Timebase Accuracy ^[1] Limit: $\pm(0.2 \text{ ppm} + 1 \text{ ppm}^{[2]}/\text{year} \times \text{Number of Years that the Instrument Has Been Used}^{[3]})$				
Channel	Test Result ΔT	Calculation Result ^[4]	Limit	Pass/Fail
CH1				

NOTE

[1]: Typical.

[2]: Clock Drift.

[3]: For the number of years that the instrument has been used, please calculate according to the date in the verification certificate provided when the instrument leaves factory.

[4]: Calculation Result = Test Result $\Delta T/1 \text{ ms}$.

6 Appendix: Test Record Form

RIGOL DS80000 Series Digital Oscilloscope Performance Verification Test Record Form

Model: _____ Tested by: _____ Test Date: _____

Impedance Test Record Form

Channel	Vertical Scale	Test Result	Limit	Pass/Fail
CH1	100 mV/div		48.5 Ω to 51.5 Ω	
	500 mV/div		48.5 Ω to 51.5 Ω	
CH2	100 mV/div		48.5 Ω to 51.5 Ω	
	500 mV/div		48.5 Ω to 51.5 Ω	
CH3	100 mV/div		48.5 Ω to 51.5 Ω	
	500 mV/div		48.5 Ω to 51.5 Ω	
CH4	100 mV/div		48.5 Ω to 51.5 Ω	
	500 mV/div		48.5 Ω to 51.5 Ω	

DC Gain Accuracy Test Record Form

Channel	Vertical Scale	Test Result			Limit	Pass/Fail
		Vavg1	Vavg2	Calculation Result ^[1]		
CH1	1 mV/div				$\leq 2\%$	
	2 mV/div				$\leq 2\%$	
	5 mV/div				$\leq 2\%$	
	10 mV/div				$\leq 2\%$	
	20 mV/div				$\leq 2\%$	
	50 mV/div				$\leq 2\%$	
	100 mV/div				$\leq 2\%$	
	200 mV/div				$\leq 2\%$	
	500 mV/div				$\leq 2\%$	
CH2	1 V/div				$\leq 2\%$	
	1 mV/div				$\leq 2\%$	
	2 mV/div				$\leq 2\%$	
	5 mV/div				$\leq 2\%$	
	10 mV/div				$\leq 2\%$	
	20 mV/div				$\leq 2\%$	
	50 mV/div				$\leq 2\%$	
	100 mV/div				$\leq 2\%$	
200 mV/div				$\leq 2\%$		

Channel	Vertical Scale	Test Result			Limit	Pass/Fail
		Vavg1	Vavg2	Calculation Result ^[1]		
	500 mV/div				≤2%	
	1 V/div				≤2%	
CH3	1 mV/div				≤2%	
	2 mV/div				≤2%	
	5 mV/div				≤2%	
	10 mV/div				≤2%	
	20 mV/div				≤2%	
	50 mV/div				≤2%	
	100 mV/div				≤2%	
	200 mV/div				≤2%	
	500 mV/div				≤2%	
	1 V/div				≤2%	
CH4	1 mV/div				≤2%	
	2 mV/div				≤2%	
	5 mV/div				≤2%	
	10 mV/div				≤2%	
	20 mV/div				≤2%	
	50 mV/div				≤2%	
	100 mV/div				≤2%	
	200 mV/div				≤2%	
	500 mV/div				≤2%	
	1 V/div				≤2%	

NOTE

[1]: The calculation formula is $[(V_{avg1} - V_{avg2}) - (V_{out1} - V_{out2})] / \text{Full Scale} \times 100\%$. Wherein, V_{out1} and V_{out2} are 3 x the current vertical scale and -3 x the current vertical scale respectively.

DC Offset Accuracy Test Record Form

Channel Setting	Vertical Scale	Offset	Test Result	Min. Value	Max. Value
CH1, 500 MHz BW	50 mV/div	0.6 V		-616.000 mV	-584.000 mV
	50 mV/div	0 V		-7.000 mV	7.000 mV
	50 mV/div	-0.6 V		584.000 mV	616.000 mV
	500 mV/div	4 V		-4.092 V	-3.908 V
	500 mV/div	0 V		-52.000 mV	52.000 mV
	500 mV/div	-4 V		3.908 V	4.092 V
CH2, 500 MHz BW	50 mV/div	0.6 V		-616.000 V	-584.000 mV
	50 mV/div	0 V		-7.000 mV	7.000 mV
	50 mV/div	-0.6 V		584.000 mV	616.000 V

Channel Setting	Vertical Scale	Offset	Test Result	Min. Value	Max. Value
	500 mV/div	4 V		-4.092 V	-3.908 V
	500 mV/div	0 V		-52.000 mV	52.000 mV
	500 mV/div	-4 V		3.908 V	4.092 V
CH3, 500 MHz BW	50 mV/div	0.6 V		-616.000 V	-584.000 mV
	50 mV/div	0 V		-7.000 mV	7.000 mV
	50 mV/div	-0.6 V		584.000 mV	616.000 V
	500 mV/div	4 V		-4.092 V	-3.908 V
	500 mV/div	0 V		-52.000 mV	52.000 mV
	500 mV/div	-4 V		3.908 V	4.092 V
CH4, 500 MHz BW	50 mV/div	0.6 V		-616.000 V	-584.000 mV
	50 mV/div	0 V		-7.000 mV	7.000 mV
	50 mV/div	-0.6 V		584.000 mV	616.000 V
	500 mV/div	4 V		-4.092 V	-3.908 V
	500 mV/div	0 V		-52.000 mV	52.000 mV
	500 mV/div	-4 V		3.908 V	4.092 V

Analog Bandwidth Test Record Form

Model	Limit	CH1	CH2	CH3	CH4
DS80804 (8 GHz)	-3 dB				
DS81304 (13 GHz)	-3 dB				

Timebase Accuracy Test Record Form

Timebase Accuracy ^[1] Limit: $\pm(0.2 \text{ ppm} + 1 \text{ ppm}^{[2]}/\text{year} \times \text{Number of Years that the Instrument Has Been Used}^{[3]})$				
Channel	Test Result ΔT	Calculation Result ^[4]	Limit	Pass/Fail
CH1				

NOTE

[1]: Typical.

[2]: Clock Drift.

[3]: For the number of years that the instrument has been used, please calculate according to the date in the verification certificate provided when the instrument leaves factory.

[4]: Calculation Result = Test Result $\Delta T/1$ ms.

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