

**AFG3000 Series
Arbitrary Function Generators
Specifications and Performance Verification
Technical Reference**

www.tektronix.com



077-0691-00

Tektronix

Copyright © Tektronix. All rights reserved. Licensed software products are owned by Tektronix or its subsidiaries or suppliers, and are protected by national copyright laws and international treaty provisions.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specifications and price change privileges reserved.

TEKTRONIX and TEK are registered trademarks of Tektronix, Inc.

Additional trademark statements can be added here.

Contacting Tektronix

Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THE PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

[W2 – 15AUG04]

Table of Contents

General safety summary	iv
Service Safety Summary.....	1
Preface	3
Finding other information.....	4
Manual conventions	4
Specifications	5
Electrical specifications	5
Input and output specifications.....	16
General specifications	17
Performance verification.....	21
Self tests	21
Error codes	23
Performance tests	25
Test record	27
Frequency/period test.....	49
Amplitude test.....	50
DC Offset test	52
AC Flatness test.....	54
Harmonics Distortion test.....	57
Total Harmonic Distortion test	59
Spurious test.....	61
Rise-Fall time test.....	64

List of Figures

Figure 1: AFG3000 Series dimensions	19
Figure 2: RM3100 Rackmount dimensions	19
Figure 3: Frequency/period test.....	49
Figure 4: 50 Ω terminator accuracy	50
Figure 5: Amplitude test.....	50
Figure 6: 50 Ω terminator accuracy	52
Figure 7: DC offset tests.....	52
Figure 8: AC flatness tests.....	54
Figure 9: Harmonic distortion tests.....	57
Figure 10: Total Harmonic distortion tests	59
Figure 11: Spurious tests	61
Figure 12: Rise-Fall time tests	64

List of Tables

Table 1: Supported products.....	3
Table 2: Operating mode	5
Table 3: Waveforms	6
Table 4: (Category) specifications	6
Table 5: Phase (except DC, Noise, and Pulse)	8
Table 6: Lead delay (pulse).....	8
Table 7: Amplitude	8
Table 8: DC offset.....	9
Table 9: Internal noise add	10
Table 10: Output characteristics	10
Table 11: Modulation	14
Table 12: Front panel	16
Table 13: Rear panel	16
Table 14: Power	17
Table 15: Environmental	17
Table 16: System characteristics	18
Table 17: Error codes	23
Table 18: Performance test items	25
Table 19: Test equipment	27
Table 20: AFG3000 Series Performance Test Record.....	28

General safety summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

To avoid fire or personal injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Ground the product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe all terminal ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Power disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do not operate without covers. Do not operate this product with covers or panels removed.

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Avoid exposed circuitry. Do not touch exposed connections and components when power is present.

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry.

Provide proper ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Terms in this manual These terms may appear in this manual:



WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*



CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols and terms on the product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbol(s) may appear on the product:



Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power. To avoid electric shock, disconnect the mains power by means of the power cord or, if provided, the power switch.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Preface

This manual provides instructions to verify the performance of the AFG3000 Series Arbitrary Function Generators to the module level.

Unless noted otherwise, the term “AFG3000 Series” refers to the models in the following table.

Table 1: Supported products

AFG3011	AFG3021B	AFG3011C
AFG3101	AFG3022B	AFG3021C
AFG3102		AFG3022C
AFG3251		AFG3051C
AFG3252		AFG3052C
		AFG3101C
		AFG3102C
		AFG3251C
		AFG3252C

To prevent personal injury or damage to the instrument, consider the following before attempting service:

- The procedures in this manual should be performed only by a qualified service person.
- Read the *General Safety Summary* and the *Service Safety Summary* at the beginning of this document.

When using this manual for servicing, be sure to follow all warnings, cautions, and notes.

The manual consists of the following sections:

- *Specifications* contains a description of the instrument and the characteristics that apply to it.
- *Performance Verification* contains procedures for confirming that the instrument functions properly and meets warranted limits.

The procedures described in this document should be performed every 12 months or after module replacement.

If the instruments do not meet performance criteria, repair is necessary.

Finding other information

This manual focuses on the performance verification of the instrument. See the following list for other documents supporting the instrument. All documents except the Online Help are on the AFG3000 Series Product Documentation CD-ROM that ship with instrument.

Document	Description
<i>AFG3000 Series Quick Start User Manual</i>	A quick reference to major features of the instrument and how they operate. It also provides several tutorials to familiarize you with basic instrument features.
<i>AFG3000 Series Programmer Manual</i>	An encyclopedia of topics that describe the instrument interface and features, and gives background information on how to use them. It provides Menu Structures, User Interface, and Programming Information.
<i>AFG3000 Series Online Help</i>	A online help system, integrated with the User Interface application that ships with this product. The help is preinstalled in the instrument.

Manual conventions

This manual uses certain conventions that you should become familiar with.

Some sections of the manual contain procedures for you to perform. To keep those instructions clear and consistent, this manual uses the following conventions:

- Front-panel controls and menu names appear in the same case (initial capitals, all uppercase, and so on) in the manual as is used on the instrument front-panel and menus. Front-panel labels are all upper case letters (for example, MENU, SELECT, PULSE GEN, and so on).
- Instruction steps are numbered unless there is only one step.

Modules Throughout this manual, any replaceable component, assembly, or part of the instrument is referred to generically as a module. In general, a module is an assembly (such as a circuit board). Sometimes a single component is a module; for example, the chassis of the instrument is a module.

Safety Symbols and terms related to safety appear in the Safety Summary near the beginning of this manual.

Specifications

These specifications apply to all AFG3000 Series Arbitrary Function Generators. All specifications are guaranteed unless labeled “typical”. Typical specifications are provided for your convenience but are not guaranteed.

Specifications that are check marked with the ✓ symbol are checked directly (or indirectly) in the Performance Verification section.

All specifications apply to the arbitrary function generator unless noted otherwise. These specifications are valid under the following conditions:

- The instrument must have been calibrated/adjusted at an ambient temperature between +20 °C and +30 °C.
- The instrument must be operating at an ambient temperature between 0 °C and +50 °C.
- The instrument must have had a warm-up period of at least 20 minutes.
- The instrument must be in an environment with temperature, altitude, and humidity within the operating limits described in these specifications.

Electrical specifications

Table 2: Operating mode

Characteristic	Description
Run mode	Continuous, Modulation, Sweep, and Burst
Burst count	1 to 1,000,000 cycles or infinite
Internal trigger rate	1.000 μ s to 500.0 s

Table 3: Waveforms

Characteristic	Description
Standard	Sine, Square, Pulse, Ramp, More (Sin(x)/x, Noise, DC, Gaussian, Lorentz, Exponential Rise, Exponential Decay, and Haversine)
Arbitrary waveform	
Waveform length	2 to 131,072
Sampling rate	
AFG3021B / 3022B / 3021C / 3022C / 3011 / 3011C	250 MS/s
AFG3101 / 3101C / 3102 / 3102C / 3051C / 3052C	250 MS/s or 1 GS/s (rate changes automatically at ≤16K)
AFG3251 / 3251C / 3252 / 3252C	250 MS/s or 2 GS/s (rate changes automatically at ≤16K)
Resolution	14 bits
Number of non-volatile waveform memories	4

Table 4: (Category) specifications

Characteristic	Description	PV reference page
Frequency range		
Sine ¹		
AFG3011 / 3011C	1 μHz to 10 MHz	
AFG3021B / 3021C / 3022B / 3022C	1 μHz to 25 MHz	
AFG3051C / 3052C	1 μHz to 50 MHz	
AFG3101 / 3101C / 3102 / 3102C	1 μHz to 100 MHz	
AFG3251 / 3251C / 3252 / 3252C	1 μHz to 240 MHz	
Square		
AFG3011 / 3011C	1 μHz to 5 MHz	
AFG3021B / 3022B	1 μHz to 12.5 MHz	
AFG3021C / 3022C	1 μHz to 25 MHz	
AFG3051C / 3052C	1 μHz to 40 MHz	
AFG3101 / 3101C / 3102 / 3102C	1 μHz to 50 MHz	
AFG3251 / 3251C / 3252 / 3252C	1 μHz to 120 MHz	
Pulse		
AFG3011 / 3011C	1 mHz to 5 MHz	

Table 4: (Category) specifications (cont.)

Characteristic	Description	PV reference page
AFG3021B / 3022B	1 mHz to 12.5 MHz	
AFG3021C / 3022C	1 mHz to 25 MHz	
AFG3051C / 3052C	1 mHz to 40 MHz	
AFG3101 / 3101C / 3102 / 3102C	1 mHz to 50 MHz	
AFG3251 / 3251C / 3252 / 3252C	1 mHz to 120 MHz	
Ramp, Sin(x)/X, Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine		
AFG3011 / 3011C	1 μ Hz to 100 kHz	
AFG3021B / 3022B	1 μ Hz to 250 kHz	
AFG3021C / 3022C	1 μ Hz to 500 kHz	
AFG3051C / 3022C	1 μ Hz to 800 kHz	
AFG3101 / 3101C / 3102 / 3102C	1 μ Hz to 1 MHz	
AFG3251 / 3251C / 3252 / 3252C	1 μ Hz to 2.4 MHz	
Arbitrary ²		
AFG3011 / 3011C	1 mHz to 5 MHz	
AFG3021B / 3021C / 3022B / 3022C	1 mHz to 12.5 MHz	
AFG3051C / 3052C	1 mHz to 25 MHz	
AFG3101 / 3101C / 3102 / 3102C	1 mHz to 50 MHz	
AFG3251 / 3251C / 3252 / 3252C	1 mHz to 120 MHz	
Noise bandwidth (-3 dB), typical		
AFG3011 / 3011C	10 MHz	
AFG3021B / 3021C / 3022B / 3022C	25 MHz	
AFG3051 / 3052C	50 MHz	
AFG3101 / 3101C / 3102 / 3102C	100 MHz	
AFG3251 / 3251C / 3252 / 3252C	240 MHz	

Table 4: (Category) specifications (cont.)

Characteristic	Description	PV reference page
Resolution	1 μ Hz or 12 digits	
✓ Accuracy stability	± 1 ppm, 0 °C to 50 °C (except Arb) ± 1 ppm ± 1 mHz, 0 °C to 50 °C (Arb)	(See page 49, Frequency/period test.)
Accuracy aging	± 1 ppm/year	

¹ Triggered/Gated Burst mode:
 AFG3011 / 3011C, 1 μ Hz to 5 MHz;
 AFG3021B/3021C/3022B/3022C, 1 μ Hz to 12.5 MHz;
 AFG3051C/3052C, 1 μ Hz to 25 MHz;
 AFG3101/3101C/3102/3102C, 1 μ Hz to 50 MHz;
 AFG3251/3251C/3252/3252C, 1 μ Hz to 120 MHz

² Triggered/Gated Burst mode:
 AFG3011 / 3011C, 1 mHz to 2.5 MHz;
 AFG3021B/3021C/3022B/3022C, 1 mHz to 6.25 MHz;
 AFG3051C/3052C, 1 MHz to 12.5 MHz;
 AFG3101/3101C/3102/3102C, 1 mHz to 25 MHz;
 AFG3251/AFG3252, 1 mHz to 60 MHz

Table 5: Phase (except DC, Noise, and Pulse)

Characteristics	Description
Range ¹	-360° to +360°

¹ Resolution: 0.01° (sine), 0.1° (other standard waveforms)

Table 6: Lead delay (pulse)

Characteristic	Description
Range	
Continuous mode	0 ps to period
Triggered/Gated Burst mode	0 ps to period – [pulse width + 0.8 * (leading edge time + trailing edge time)]
Resolution	10 ps or 8 digits

Table 7: Amplitude

Characteristic	Description	PV reference page
Range ¹		
AFG3011 / 3011C	20 mV _{p-p} to 20 V _{p-p} 40 mV _{p-p} to 40 V _{p-p} (into open circuit load)	
AFG3021B / 3021C / 3022B / 3022C / 3051C / 3052C	10 mV _{p-p} to 10 V _{p-p} 20 mV _{p-p} to 20 V _{p-p} (into open circuit load)	
AFG3101 / 3101C / 3102 / 3102C	20 mV _{p-p} to 10 V _{p-p} 40 mV _{p-p} to 20 V _{p-p} (into open circuit load)	

Table 7: Amplitude (cont.)

Characteristic	Description	PV reference page
AFG3251 / 3252 / 3251C / 3252C	50 mV _{p-p} to 5 V _{p-p} 100 mV _{p-p} to 10 V _{p-p} (into open circuit load)	
✓ Accuracy		(See page 50, Amplitude test.)
AFG3011 / 3011C	±(2% of setting +2 mV) (at 1 kHz sine waveform amplitude > 10 mV _{p-p} , 0V offset)	
AFG3021B / 3021C / 3022B / 3022C / 3101 / 3101C / 3102 / 3102C / 3251 / 3251C / 3252 / 3252C	±(1% of setting +1 mV) (at 1 kHz sine waveform, amplitude > 10 mV _{p-p} , 0 V offset)	
Resolution	0.1 mV _{p-p} , 0.1 mV _{rms} , 1 mV, 0.1 dBm or 4 digits	
Units ²	V _{p-p} , V _{rms} , dBm, and Volt (High level and Low level)	
Output impedance	50 Ω	
Isolation	42 V _{pk} maximum to earth	

¹ AFG3251/ 3251C / 3252 / 3252C (frequency range: >200 MHz to 240 MHz): 50 mV_{p-p} to 4 V_{p-p} into 50 Ω, 100 mV_{p-p} to 8 V_{p-p} into open circuit load

² dBm is used only for sine waveform. V_{rms} is not available for Arb and Noise waveforms.

Table 8: DC offset

Characteristic	Description	PV reference page
Range		
AFG3011 / 3011C	±(10 V _{pk} ac+dc into 50 Ω ±(20 V _{pk} ac+dc into open circuit)	
AFG3021B / 3021C / 3022B / 3022C / 3051C / 3052C	±(5 V _{pk} ac+dc into 50 Ω ±(10 V _{pk} ac+dc into open-circuit load)	
AFG3101 / 3101C / 3102 / 3102C	±5 V DC into 50 Ω load ±10 V _{pk} ac+dc into open-circuit load	
AFG3251 / 3251C / 3252 / 3252C	±2.5 V DC into 50 Ω load ±5 V DC open circuit	
✓ Accuracy ¹	±(1% of setting +5 mV + 0.5% of amplitude (V _{p-p})) (except for AFG3011C) ±(2% of setting +10 mV + 1% of amplitude (V _{p-p})) (AFG3011C)	(See page 52, DC Offset test.)
AFG3011 / 3011C		
AFG3021B / 3021C / 3022B / 3022C / 3101 / 3101C / 3102 / 3102C / 3251 / 3251C / 3252 / 3252C	±(1% of setting +5 mV + 0.5% of amplitude (V _{p-p}))	
Resolution	1 mV	

Table 8: DC offset (cont.)

Characteristic	Description	PV reference page
Output impedance	50 Ω	

¹ AFG3011 / 3011C: Add 1.0 mV per °C for operation outside the range of 20 °C to 30 °C.
 AFG3021B / 3021C / 3022B / 3022C and AFG3101 / 31010C / 3102 / 3102C: Add 0.5 mV per °C for operation outside the range of 20 °C to 30 °C.
 AFG3251 / 3251C / 3252 / 3252C: Add 2.0 mV per °C for operation outside the range of 20 °C to 30 °C.

Table 9: Internal noise add

Characteristic	Description
Range	0% to 50% of amplitude setting
Resolution	1%

Table 10: Output characteristics

Characteristic	Description	PV reference page
Sine wave		
✓ Flatness (at 1.0 V _{p-p} amplitude (+4 dBm), relative to 100 kHz)		(See page 54, AC Flatness test.)
AFG3011 / 3011C	< 5 MHz: ± 0.15 dB 5 MHz \leq frq \leq 10 MHz: ± 0.3 dB	
AFG3021B / 3021C / 3022B / 3022C	< 5 MHz: ± 0.15 dB 5 MHz \leq frq < 20 MHz: ± 0.3 dB 20 MHz \leq frq \leq 25 MHz: ± 0.5 dB	
AFG3051C / 3052C	< 5 MHz: ± 0.15 dB 5 MHz \leq frq < 45 MHz: ± 0.3 dB 45MHz \leq frq \leq 50 MHz: ± 0.5 dB	
AFG3101 / 3101C / 3102 / 3102C	< 5 MHz: ± 0.15 dB 5 MHz \leq frq < 25 MHz: ± 0.3 dB 25 MHz \leq frq \leq 100 MHz: ± 0.5 dB	
AFG3251 / 3251C / 3252 / 3252C	< 5 MHz: ± 0.15 dB 5 MHz \leq frq < 25 MHz: ± 0.3 dB 25 MHz \leq frq < 100 MHz: ± 0.5 dB 100 MHz \leq frq < 200 MHz: ± 1.0 dB 200 MHz \leq frq \leq 240 MHz: ± 2.0 dB	
✓ Harmonic distortion (at 1.0 V _{p-p} amplitude)		(See page 57, Harmonics Distortion test.)
AFG3011 / 3011C	10 Hz \leq frq < 20 kHz: < -60 dBc 20 kHz \leq frq < 1 MHz: < -55 dBc 1 MHz \leq frq \leq 10 MHz: < -45 dBc	

Table 10: Output characteristics (cont.)

Characteristic	Description	PV reference page
AFG3021B / 3021C / 3022B / 3022C	10 Hz ≤ frq < 20 kHz: < -70 dBc 20 kHz ≤ frq < 1 MHz: < -60 dBc 1 MHz ≤ frq < 10 MHz: < -50 dBc 10 MHz ≤ frq ≤ 25 MHz: < -40 dBc	
AFG3051C / 3052C	10 Hz ≤ frq < 20 kHz: < -70 dBc 20 kHz ≤ frq < 1 MHz: < -60 dBc 1 MHz ≤ frq < 5 MHz: < -50 dBc 5 MHz ≤ frq ≤ 50 MHz: < -40 dBc	
AFG3101 / 3101C / 3102 / 3102C	10 Hz ≤ frq < 1 MHz: < -60 dBc 1 MHz ≤ frq < 5 MHz: < -50 dBc 5 MHz ≤ frq ≤ 100 MHz: < -37 dBc	
AFG3251 / 3251C / 3252 / 3252C	10 Hz ≤ frq < 1 MHz: < -60 dBc 1 MHz ≤ frq < 5 MHz: < -50 dBc 5 MHz ≤ frq < 25 MHz: < -37 dBc 25 MHz ≤ frq ≤ 240 MHz: < -30 dBc	
✓ Total harmonic distortion (at 1 V _{p-p} amplitude)	10 Hz to 20 kHz: < 0.2%	(See page 59, Total Harmonic Distortion test.)
✓ Spurious ¹ (nonharmonic) (at 1 V _{p-p} amplitude)		(See page 61, Spurious test.)
AFG3011 / 3011C	10 Hz ≤ frq < 1 MHz: < -60 dBc 1 MHz ≤ frq ≤ 10 MHz: < -50 dBc	
AFG3021B / 3021C / 3022B / 3022C	10 Hz ≤ frq < 1 MHz: < -60 dBc 1 MHz ≤ frq ≤ 25 MHz: < -50 dBc	
AFG3051C / 3052C	10 Hz ≤ frq < 1 MHz: < -60 dBc 1 MHz ≤ frq ≤ 50 MHz: < -50 dBc	
AFG3101 / 3101C / 3102 / 3102C	10 Hz ≤ frq < 1 MHz: < -60 dBc 1 MHz ≤ frq < 25 MHz: < -50 dBc 25 MHz ≤ frq ≤ 100 MHz: -50 dBc + 6 dBc/octave	
AFG3251 / 3251C / 3252 / 3252C	10 Hz ≤ frq < 1 MHz: < -50 dBc 1 MHz ≤ frq < 25 MHz: < -47 dBc 25 MHz ≤ frq ≤ 240 MHz: -47 dBc + 6 dBc/octave	
Phase noise, typical (at 1 V _{p-p} amplitude)		
AFG3011 / 3011C	10 MHz: < -110 dBc/Hz at 10 kHz offset	
AFG3021B / 3021C / 3022B / 3022C / 3051C / 3052C / 3101 / 3101C / 3102 / 3102C	20 MHz: < -110 dBc/Hz at 10 kHz offset	
Residual clock noise, typical		
AFG3011 / 3011C / 3021B / 3021C / 3022B / 3022C / 3051C / 3052C	-63 dBm	

Table 10: Output characteristics (cont.)

Characteristic	Description	PV reference page
AFG3101 / 3101C / 3102 / 3102C / 3251C / 3251C / 3252 / 3252C	-57 dBm	
Square wave		
↗ Rise time/fall time		(See page 64, Rise-Fall time test.)
AFG3011 / 3011C	≤ 50 ns	
AFG3021B / 3021C / 3022B / 3022C	≤ 9 ns	
AFG3051C / 33052C	≤ 7 ns	
AFG3101 / 3101C / 3102 / 3102C	≤ 5 ns	
AFG3251 / 3251C / 3252 / 3252C	≤ 2.5 ns	
Jitter (rms), typical		
AFG3011 / 3011C / 3021B / 3021C / 3022B / 3022C	500 ps	
AFG3051C / 33052C	300 ps	
AFG3101 / 3101C / 3102 / 3102C	200 ps	
AFG3251 / 3251C / 3252 / 3252C	100 ps	
Pulse		
Pulse width		
AFG3011 / 3011C	80 ns to 999.99 s	
AFG3021B / 3021C / 3022B / 3022C	16 ns to 999.99 s	
AFG3051C / 33052C	12 ns to 999.99 s	
AFG3101 / 3101C / 3102 / 3102C	8 ns to 999.99 s	
AFG3251 / 3251C / 3252 / 3252C	4 ns to 999.99 s	
Resolution	10 ps or 5 digits	
Pulse duty	0.001% to 99.999%	
Leading edge/trailing edge transition time (at 10% to 90% of amplitude, respectively)		
AFG3011 / 3011C	50 ns to 0.625 * pulse period	
AFG3021B / 3021C / 3022B / 3022C	9 ns to 0.625 * pulse period	

Table 10: Output characteristics (cont.)

Characteristic	Description	PV reference page
AFG3051C / 33052C	7 ns to 0.625 * pulse period	
AFG3101 / 3101C / 3102 / 3102C	5 ns to 0.625 * pulse period	
AFG3251 / 3251C / 3252 / 3252C	2.5 ns to 0.625 * pulse period	
Resolution	10 ps or 4 digits	
Overshoot, typical	< 5%	
Jitter (rms), typical		
AFG3011 / 3011C / 3021B / 3021C / 3022B / 3022C	500 ps	
AFG3051C / 33052C	300 ps	
AFG3101 / 3101C / 3102 / 3102C	200 ps	
AFG3251 / 3251C / 3252 / 3252C	100 ps	
Ramp		
Linearity (at frequency: 1 kHz, amplitude: 1 V _{p-p} , symmetry: 100%)		
AFG3011 / 3011C / 3251 / 3251C / 3252 / 3252C	≤ 0.2% of peak output at 10% to 90% of amplitude range	
AFG3021B / 3021C / 3022B / 3022C / 3051C / 3052C	≤ 0.1% of peak output at 10% to 90% of amplitude range	
AFG3101 / 3101C / 3102 / 3102C	≤ 0.15% of peak output at 10% to 90% of amplitude range	
Symmetry	0% to 100%	
Arbitrary		
Rise time/fall time, typical		
AFG3011 / 3011C	≤ 80 ns	
AFG3021B / 3021C / 3022B / 3022C	≤ 14 ns	
AFG3051C / 33052C	≤ 10 ns	
AFG3101 / 3101C / 3102 / 3102C	≤ 8 ns	
AFG3251 / 3251C / 3252 / 3252C	≤ 3 ns	
Jitter (rms), typical		
AFG3011 / 3011C / 3021B / 3021C / 3022B / 3022C	4 ns	

Table 10: Output characteristics (cont.)

Characteristic	Description	PV reference page
AFG3051C / 3052C / 3101 / 3101C / 3102 / 3102C	1 ns at 1 GS/s 4 ns at 250 MS/s	
AFG3251 / 3251C / 3252 / 3252C	500 ps at 2 GS/s 4 ns at 250 MS/s	

¹ Exclude harmonics and channel crosstalk.

Table 11: Modulation

Characteristic	Description
AM (Amplitude Modulation)	
Carrier waveforms	Standard waveforms (except Pulse, DC, and Noise) and Arb
Modulation source	Internal or External
Internal modulating waveforms	Sine, Square, Ramp, Noise, and Arb ¹
Internal modulating frequency	2 mHz to 50.00 kHz
Depth	0.0% to 120.0%
FM (Frequency Modulation)	
Carrier waveforms	Standard waveforms (except Pulse, DC, and Noise) and Arb
Modulation source	Internal or External
Internal modulating waveforms	Sine, Square, Ramp, Noise, and Arb ²
Internal modulating frequency	2 mHz to 50.00 kHz
Peak deviation	
AFG3011 / 3011C	DC to 5 MHz
AFG3021B / 3021C / 3022B / 3022C	DC to 12.5 MHz
AFG3051C / 3052C	DC to 25 MHz
AFG3101 / 3101C / 3102 / 3102C	DC to 50 MHz
AFG3251 / 3251C / 3252 / 3252C	DC to 120 MHz
PM (Phase Modulation)	
Carrier waveforms	Standard waveforms (except Pulse, DC, and Noise) and Arb
Modulation source	Internal or External
Internal modulating waveforms	Sine, Square, Ramp, Noise, and Arb ²
Internal modulating frequency	2 mHz to 50.00 kHz
Phase deviation range	0.0 to 180.0 degrees

Table 11: Modulation (cont.)

Characteristic	Description
FSK (Frequency Shift Keying)	
Carrier waveforms	Standard waveforms (except Pulse, DC, and Noise) and Arb
Modulation source	Internal or External
Internal key rate	2 mHz to 1.000 MHz
Number of keys	2
PWM (Pulse Width Modulation)	
Carrier waveforms	Pulse
Modulation source	Internal or External
Internal modulating waveforms	Sine, Square, Ramp, Noise, and Arb ²
Internal modulating frequency	2 mHz to 50.00 kHz
Deviation range	0.0% to 50.0% of pulse period
Sweep	
Type	Linear or Logarithmic
Start/stop frequency (except Arb) ³	
AFG3011 / 3011C	1 μ Hz to 10 MHz
AFG3021B / 3021C / 3022B / 3022C	1 μ Hz to 25 MHz
AFG3051C / 3052C	1 μ Hz to 50 MHz
AFG3101 / 3101C / 3102 / 3102C	1 μ Hz to 100 MHz
AFG3251 / 3251C / 3252 / 3252C	1 μ Hz to 240 MHz
Start/stop frequency (Arb)	
AFG3011 / 3011C	1 mHz to 5 MHz
AFG3021B / 3021C / 3022B / 3022C	1 mHz to 12.5 MHz
AFG3051C / 3052C	1 mHz to 25 MHz
AFG3101 / 3101C / 3102 / 3102C	1 mHz to 50 MHz
AFG3251 / 3251C / 3252 / 3252C	1 mHz to 120 MHz
Sweep/hold/return time ⁴	
Range	1 ms to 300 s (sweep time) 0 ms to 300 s (hold/return time)

Table 11: Modulation (cont.)

Characteristic	Description
Resolution	1 ms or 4 digits
Total sweep time accuracy, typical	≤ 0.4%

- 1 The maximum waveform length for Arb is 4,096. Waveform data points over 4,096 are ignored.
- 2 The maximum waveform length for Arb is 2,048. Waveform data points over 2,048 are ignored.
- 3 Pulse, DC, and Noise waveforms are not available. Start and stop frequencies depend on the waveform shape.
- 4 Total sweep time = Sweep time + Hold time + Return time ≤ 300 s

Input and output specifications

Table 12: Front panel

Characteristic	Description
Trigger output	
Level	Positive TTL level pulse into 1 kΩ
Impedance	50 Ω
Jitter (rms), typical	
AFG3011 / 3011C / 3021B / 3021C / 3022B / 3022C	500 ps
AFG3051C / 3052C	300 ps
AFG3101 / 3101C / 3102 / 3102C	200 ps
AFG3251 / 3251C / 3252 / 3252C	100 ps
Trigger input	
Level	TTL compatible
Pulse width	100 ns minimum
Impedance	10 kΩ
Slope	Positive/negative, selectable
Trigger delay	0.0 ns to 85.000 s Resolution: 100 ps or 5 digits
Jitter (rms), typical	Burst: < 500 ps (trigger input to signal output)

Table 13: Rear panel

Characteristic	Description
External modulation input	
Input range	±1.0 V full scale (except FSK) 3.3 V logic level (FSK)
Impedance	10 kΩ

Table 13: Rear panel (cont.)

Characteristic	Description
Frequency range	AM, FM, PM, FSK, PWM: DC to 25 kHz (sampling rate: 122 kS/s)
External reference output	AFG3011 / 3011C / 3101 / 3101C / 3102 / 3102C / 3251 / 3251C / 3252 / 3252C
Impedance	50 Ω , AC coupled
Amplitude, typical	1.2 Vp-p into 50 Ω
External reference input	
Impedance	1 k Ω , AC coupled
Required input voltage swing	100 mVp-p to 5 Vp-p
Lock range	10 MHz \pm 35 kHz
CH1 Additional input	AFG3101 / 3101C / 3102 / 3102C / 3251 / 3251C / 3252 / 3252C
Impedance	50 Ω
Input range	-1 V to +1 V (DC + peak AC)
Bandwidth	DC to 10 MHz (-3 dB) at 1 Vp-p

General specifications

Table 14: Power

Characteristic	Description
Source voltage and frequency	100 V to 240 V, 47 Hz to 63 Hz 115 V, 360 to 440 Hz
Power consumption	Less than 120 W

Table 15: Environmental

Characteristic	Description
Temperature range	
Operating	0 $^{\circ}$ C to +50 $^{\circ}$ C
Non operating	-30 $^{\circ}$ C to +70 $^{\circ}$ C
Humidity	
Operating (non condensing)	0 $^{\circ}$ C to +40 $^{\circ}$ C: \leq 80% +40 $^{\circ}$ C to +50 $^{\circ}$ C: \leq 60%
Non operating (non condensing)	<+40 $^{\circ}$ C: 5% to 90% \geq +40 $^{\circ}$ C to \leq +60 $^{\circ}$ C: 5% to 80% >+60 $^{\circ}$ C to \leq +70 $^{\circ}$ C: 5% to 40%
Altitude	
Operating	Up to 3,000 meters (9,843 feet)
Non operating	Up to 12,000 meters (39,370 feet)

Table 16: System characteristics

Characteristic	Description		
Warm-up time, typical	20 minutes minimum		
Power on self diagnostics, typical	< 10 s		
Configuration times, typical	<i>USB</i>	<i>LAN</i>	<i>GPIB</i>
Function change	81 ms	81 ms	81 ms
Frequency change (except Pulse)	2.5 ms	6 ms	3.2 ms
Frequency change (Pulse)	40 ms	37 ms	32 ms
Amplitude change	90 ms	97 ms	90 ms
Select user Arbitrary waveform is 4K points (USB memory)	48 ms	50 ms	49 ms
Select user Arbitrary waveform is 128K points (USB memory)	260 ms	266 ms	240 ms
Data download, typical	4000 points Arb waveform data (8 Kbytes) GPIB: 320 ms USB: 47 ms LAN: 78 ms		
Acoustic noise, typical	< 50 dBA		
Weight (approximate)	4.5 kg (9.92 lbs)		
Dimensions	Refer to the following illustrations.		

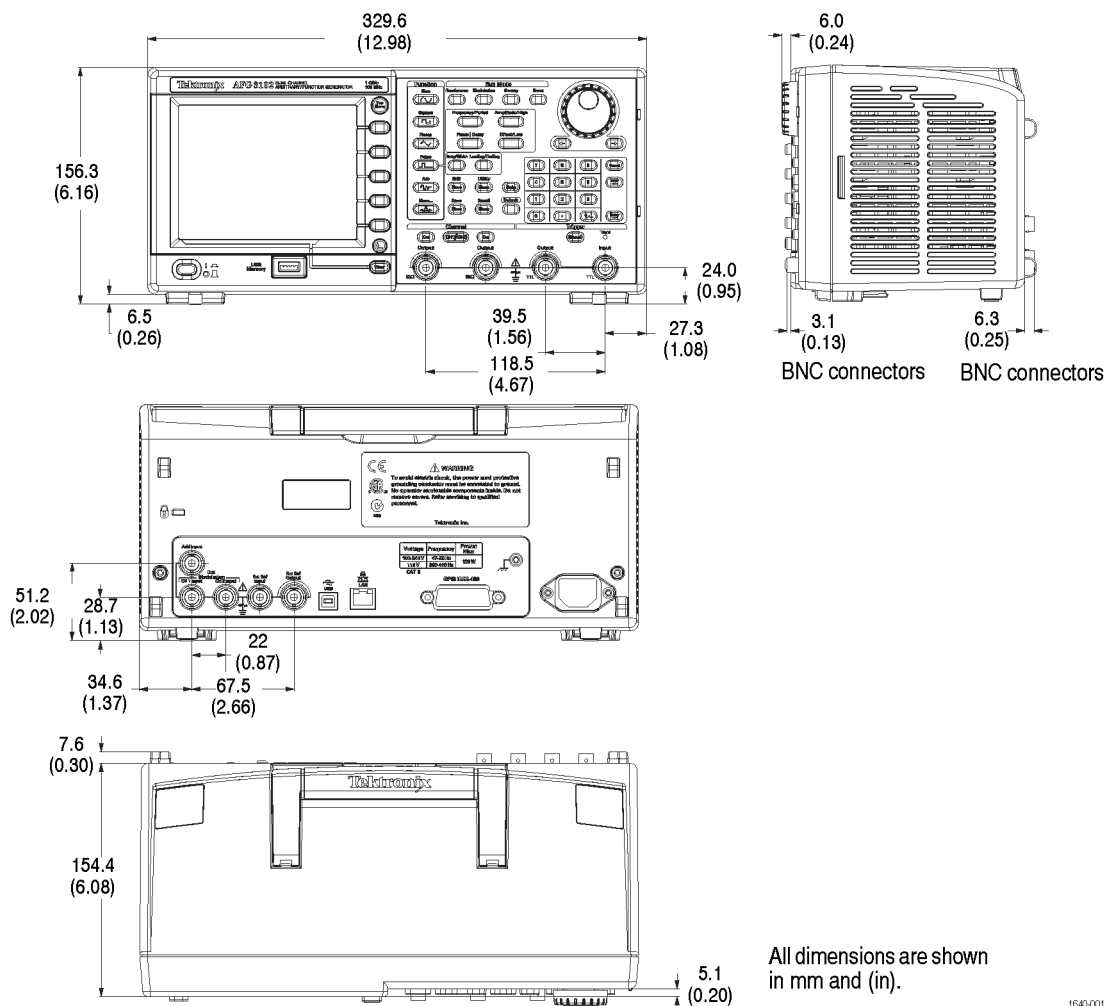


Figure 1: AFG3000 Series dimensions

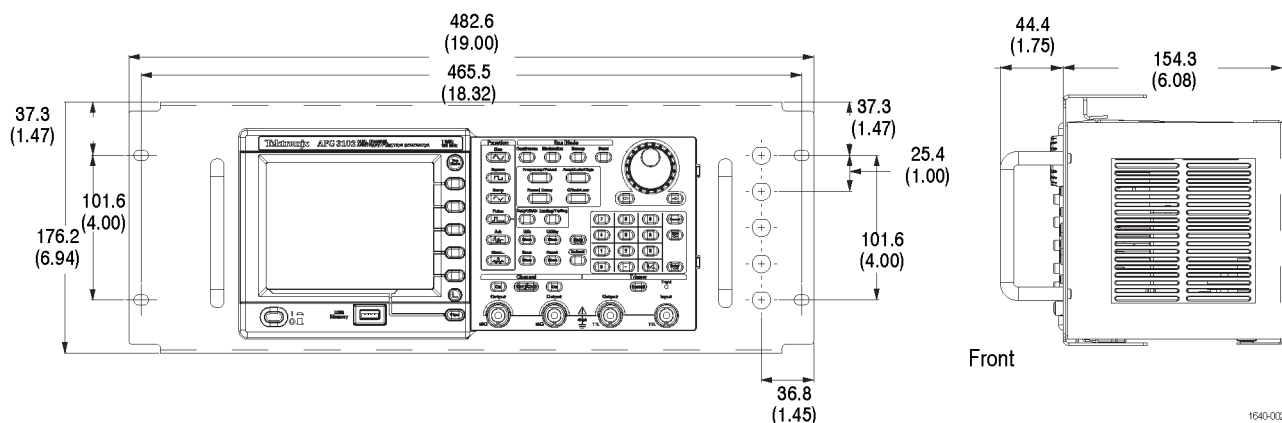


Figure 2: RM3100 Rackmount dimensions

Performance verification

Two types of Performance Verification procedures can be performed on this product: Self Tests and Performance Tests. You may not need to perform all of these procedures, depending on what you want to accomplish.

- To quickly confirm that the AFG3000 Series Arbitrary Function Generators are operating properly, complete the Self Tests.
 - Advantage: These procedures require minimal time to perform, and test the internal hardware of the AFG3000 Series Arbitrary Function Generators.
- To further check functionality and proper calibration, first complete the Self Tests; then complete the Performance Tests.
 - Advantages: These procedures add direct checking of warranted specifications. These procedures require suitable test equipment and more time to execute. (See Table 19 on page 27.)

Self tests

There are two types of tests in this section that provide a quick way to confirm basic functionality and proper adjustment:

- Diagnostics
- Calibration (you must perform this calibration before the performance tests.)

These procedures use internal diagnostics to verify that the instrument passes the internal circuit tests, and calibration routines to check and adjust the instrument internal calibration constants.

Diagnostics

This procedure uses internal routines to verify that the instrument is operating correctly.

Equipment required

None

Prerequisites

- Power on the instrument and allow a 20 minute warm-up before doing this procedure.
 - The instrument must be operating at an ambient temperature between +0 °C and +50 °C.
-

Do the following steps to run the internal routines that confirm basic functionality and proper adjustment:

1. Select Diagnostics in the Utility menu:

Utility (front-panel) > -more- (bezel) > Diagnostics/Calibration > Execute Diagnostics

2. Wait until the test is completed.
3. Verify passing of the diagnostics.

If the diagnostics completes without finding any problems, the message “PASSED” is displayed.

When an error is detected during diagnostic execution, the instrument displays an error code. Error codes are described in Error codes on (See page 23, *Error codes*.).

4. Press any front-panel button to exit the calibration.

Calibration

This procedure uses internal routines to verify that the instrument is operating correctly.

Equipment required

None

Prerequisites

- Power on the instrument and allow a 20 minute warm-up before doing this procedure.
- An ambient temperature is between +20 °C and +30 °C.

Do the following steps to run the internal routines that confirm basic functionality and proper adjustment:

1. Select Diagnostics in the Utility menu;

Utility (front-panel) > -more- (bezel) > Diagnostics/Calibration > Execute Calibration

2. Wait until the test is completed.
3. Verify passing of the calibration.

If the calibration completes without any problems, the message “PASSED” is displayed.

When an error is detected during calibration execution, the instrument displays an error code. Error codes are described in Error Codes on (See page 23, *Error codes*.).

4. Press any front-panel button to exit the diagnostics.

NOTE. Do not turn off the power while executing calibration. If the power is turned off during calibration, data stored in internal nonvolatile memory may be lost.

Error codes

If Diagnostics detects a malfunction, it displays the character string “Fail” and the error code. (See Table 17.) describes the Error code and related modules Category of the Diagnostics Error Code.

(See Table 17.) shows the error code and related modules reporting a failure.

Table 17: Error codes

Error code	Description	Related module
— Calibration Error Codes—		
1101	CH1 Internal offset calibration failure	A1x/A3x/A4x/A51/A61
1102	CH2 Internal offset calibration failure	A12/A32/A42/A51/A61
1103	CH1 Output offset calibration failure	A1x/A3x/A4x/A51/A61
1104	CH2 Output offset calibration failure	A12/A32/A42/A51/A61
1105	CH1 Output gain Calibration failure	A1x/A3x/A4x/A51/A61
1106	CH2 Output gain Calibration failure	A12/A32/A42/A51/A61
1201	CH1 x3dB attenuator calibration failure	A1x/A3x/A4x/A51/A61
1202	CH2 x3dB attenuator calibration failure	A12/A32/A42/A51/A61
1203	CH1 x6dB attenuator calibration failure	A1x/A3x/A4x/A51/A61
1204	CH2 x6dB attenuator calibration failure	A12/A32/A42/A51/A61
1205	CH1 x10dB attenuator calibration failure	A1x/A3x/A4x/A51/A61
1206	CH2 x10dB attenuator calibration failure	A12/A32/A42/A51/A61
1207	CH1 x20dB 1 attenuator calibration failure	A1x/A3x/A4x/A51/A61
1208	CH2 x20dB 1 attenuator calibration failure	A12/A32/A42/A51/A61
1209	CH1 x20dB 2 attenuator calibration failure	A1x/A3x/A4x/A51/A61
1210	CH2 x20dB 2 attenuator calibration failure	A12/A32/A42/A51/A61
1211	CH1 Filter calibration failure	A1x/A3x/A4x/A51/A61
1212	CH2 Filter calibration failure	A12/A32/A42/A51/A61
1213	CH1 x20dB 3 attenuator calibration failure	A43
1301	CH1 Sine Flatness calibration failure	A1x/A3x/A4x/A51/A61
1302	CH2 Sine Flatness calibration failure	A12/A32/A42/A51/A61
1401	CH1 ASIC TINT calibration failure	A1x/A3x/A4x/A51/A61
1402	CH2 ASIC TINT calibration failure	A12/A32/A42/A51/A61
1403	CH1 ASIC SGEN calibration failure	A1x/A3x/A4x/A51/A61
1404	CH2 ASIC SGEN calibration failure	A12/A32/A42/A51/A61
1405	CH1 ASIC clock duty calibration failure	A1x/A3x/A4x/A51/A61
1406	CH2 ASIC clock duty calibration failure	A12/A32/A42/A51/A61
— Diagnostics Error Codes—		
2100	Calibration data not found	A72
2101	Calibration data checksum	A72

Table 17: Error codes (cont.)

Error code	Description	Related module
2102	Calibration data invalid	A72
2201	ASIC1 memory failure	A1x/A3x/A4x
2202	ASIC2 memory failure	A12/A32/A42
2203	ASIC1 Overheat	A1x/A3x/A4x
2204	ASIC2 Overheat	A12/A32/A42
— Output Diagnostics Error Codes —		
2301	CH1 Internal offset failure	A1x/A3x/A4x
2302	CH2 Internal offset failure	A12/A32/A42
2303	CH1 Output offset failure	A1x/A3x/A4x/A51/A61
2304	CH2 Output offset failure	A12/A32/A42/A51/A61
2305	CH1 Output gain failure	A1x/A3x/A4x/A51/A61
2306	CH2 Output gain failure	A12/A32/A42/A51/A61
2401	CH1 x3dB attenuator failure	A1x/A3x/A4x
2402	CH2 x3dB attenuator failure	A12/A32/A42
2403	CH1 x6dB attenuator failure	A1x/A3x/A4x
2404	CH2 x6dB attenuator failure	A12/A32/A42
2405	CH1 x10dB attenuator failure	A1x/A3x/A4x
2406	CH2 x10dB attenuator failure	A12/A32/A42
2407	CH1 x20dB 1 attenuator failure	A1x/A3x/A4x
2408	CH2 x20dB 1 attenuator failure	A12/A32/A42
2409	CH1 x20dB 2 attenuator failure	A1x/A3x/A4x
2410	CH2 x20dB 2 attenuator failure	A12/A32/A42
2411	CH1 Filter failure	A51/A61
2412	CH2 Filter failure	A51/A61
2413	CH1 x20dB 3 attenuator failure	A43
2501	CH1 Sine Flatness failure	A1x/A3x/A4x/A51/A61
2502	CH2 Sine Flatness failure	A12/A32/A42/A51/A61

Performance tests

The Performance Tests include functional tests, such as the interface functional test, in this manual.

- The Functional Tests verify the functions; they verify that the AFG3000 Series Arbitrary Function Generators features operate. They do not verify that they operate within limits.
- The Performance Tests verify that the AFG3000 Series Arbitrary Function Generators performs as warranted. The Performance Tests check all the characteristics that are designated as checked in Specifications.

Table 18: Performance test items

Titles	Test items	Reference Page
Frequency/Period Test	Internal clock output frequency accuracy	(See page 49, <i>Frequency/period test.</i>)
Amplitude Test	Amplitude accuracy	(See page 50, <i>Amplitude test.</i>)
DC Offset Test	Amplitude accuracy	(See page 52, <i>DC Offset test.</i>)
AC Flatness Test	AC Flatness	(See page 54, <i>AC Flatness test.</i>)
Harmonic Distortion Test	Harmonic Distortion	(See page 57, <i>Harmonics Distortion test.</i>)
THD (Total Harmonic Distortion) Test	Total Harmonic Distortion	(See page 59, <i>Total Harmonic Distortion test.</i>)
Spurious Test	Spurious	(See page 61, <i>Spurious test.</i>)
Rise-Fall Time Test	Rise-Fall Time	(See page 64, <i>Rise-Fall time test.</i>)

Performance conditions

The tests in this section comprise an extensive, valid confirmation of performance and functionality when the following requirements are met:

- The cabinet covers must be on the AFG3000 Series.
- The instrument must have been performed and passed the procedures under calibration and diagnostics.
- The instrument must have been calibrated/adjusted at an ambient temperature between +20 °C and +30 °C.

- The instrument must be operating at an ambient temperature between +0 °C and +50 °C.
- The instrument must have had a warm-up period of at least 20 minutes.

Equipment required The following table lists the required equipment used to complete the performance tests.

Table 19: Test equipment

Description	Minimum requirements	Recommended equipment	Purpose
1. Digital Multi Meter (DMM)	AC volts, true rms, AC coupled Accuracy: $\pm 0.1\%$ to 1 kHz DC volts Accuracy: 50 ppm, resolution 100 μV Resistance Accuracy: $\pm 0.05 \Omega$	Agilent 3458A	Measures voltage. Used in multiple procedures.
2. Power Meter	100 kHz to 250 MHz 1 μW to 100 mW (-30 dBm to +20 dBm) Accuracy: 0.02 dB Resolution: 0.01 dB	R&S NRVS	Measures voltage. Used in multiple procedures.
3. Power Head	100 kHz to 250 MHz 1 μW to 100 mW (-30 dBm to +20 dBm)	R&S NRV-Z5	Measures voltage. Used in multiple procedures.
4. Frequency Counter	Accuracy: 0.01 ppm Phase measurement	Agilent 53132A	Checks clock frequency.
5. Oscilloscope	1 GHz Bandwidth 50 Ω input termination	Tektronix TDS5104B	Checks output signals. Used in multiple procedures.
6. Spectrum Analyzer	20 kHz to 1.25 GHz	Tektronix RSA3303A	Checks output signals. Harmonics Spurious.
7. BNC Coaxial Cable	50 Ω , male to male BNC connector, 91 cm	Tektronix part number 012-0482-00	Signal interconnection
8. BNC terminator	50 Ω , $\pm 1 \Omega$, 2 W, DC to 1 GHz, BNC	Tektronix part number 011-0049-02	Signal termination
9. Attenuator	50 Ω , x10, BNC	Tektronix part number 011-0059-03	Signal attenuation
10. Adapter Dual-Banana Plug	BNC (female) to dual banana	Tektronix part number 103-0090-00	Signal interconnection to a DMM
11. Adapter BNC(female)-N(male)	BNC (female) to N (male)	Tektronix part number 103-0045-00	Signal interconnection to a Spectrum Analyzer

Test record

Photocopy the test records and use them to record the performance test results for your AFG3000 Series Arbitrary Function Generators.

Table 20: AFG3000 Series Performance Test Record

Instrument Serial Number:	Certificate Number:
Temperature:	RH %:
Date of Calibration:	Technician:

Frequency, Amplitude, DC Offset, and AC Flatness Test Record

	Minimum	Test result	Maximum
Frequency			
Sine at 1.000000 MHz	0.999999 MHz		1.000001 MHz
Pulse at 1.000000 MHz	0.999999 MHz		1.000001 MHz

Amplitude (AFG3011 / 3011C)

$$CF = 2 / (1 + 50 \Omega / \text{Measurement } \Omega) =$$

CH1 Amplitude	Minimum	Test result	Maximum
30.0 mVrms at 1.00 kHz	$(30.0 \times CF - 1.307)$ mVrms		$(30.0 \times CF + 1.307)$ mVrms
300.0 mVrms at 1.00 kHz	$(300.0 \times CF - 6.71)$ mVrms		$(300.0 \times CF + 6.71)$ mVrms
800.0 mVrms at 1.00 kHz	$(800.0 \times CF - 16.71)$ mVrms		$(800.0 \times CF + 16.71)$ mVrms
1.500 Vrms at 1.00 kHz	$(1.500 \times CF - 0.0307)$ Vrms		$(1.500 \times CF + 0.0307)$ Vrms
2.000 Vrms at 1.00 kHz	$(2.000 \times CF - 0.0407)$ Vrms		$(2.000 \times CF + 0.0407)$ Vrms
2.500 Vrms at 1.00 kHz	$(2.500 \times CF - 0.0507)$ Vrms		$(2.500 \times CF + 0.0507)$ Vrms
3.500 Vrms at 1.00 kHz	$(3.500 \times CF - 0.0707)$ Vrms		$(3.500 \times CF + 0.0707)$ Vrms

Amplitude (AFG302xB / 302xC / 305xC / 310x / 310xC)

$$CF = 2 / (1 + 50 \Omega / \text{Measurement } \Omega) =$$

CH1 Amplitude	Minimum	Test result	Maximum
30.0 mVrms at 1.00 kHz	$(30.0 \times CF - 0.654)$ mVrms		$(30.0 \times CF + 0.654)$ mVrms
300.0 mVrms at 1.00 kHz	$(300.0 \times CF - 3.35)$ mVrms		$(300.0 \times CF + 3.35)$ mVrms
800.0 mVrms at 1.00 kHz	$(800.0 \times CF - 8.35)$ mVrms		$(800.0 \times CF + 8.35)$ mVrms
1.500 Vrms at 1.00 kHz	$(1.500 \times CF - 0.0154)$ Vrms		$(1.500 \times CF + 0.0154)$ Vrms
2.000 Vrms at 1.00 kHz	$(2.000 \times CF - 0.0204)$ Vrms		$(2.000 \times CF + 0.0204)$ Vrms
2.500 Vrms at 1.00 kHz	$(2.500 \times CF - 0.0254)$ Vrms		$(2.500 \times CF + 0.0254)$ Vrms
3.500 Vrms at 1.00 kHz	$(3.500 \times CF - 0.0354)$ Vrms		$(3.500 \times CF + 0.0354)$ Vrms

CH2 Amplitude	Minimum	Test result	Maximum
30.0 mVrms at 1.00 kHz	$(30.0 \times CF - 0.654)$ mVrms		$(30.0 \times CF + 0.654)$ mVrms
300.0 mVrms at 1.00 kHz	$(300.0 \times CF - 3.35)$ mVrms		$(300.0 \times CF + 3.35)$ mVrms
800.0 mVrms at 1.00 kHz	$(800.0 \times CF - 8.35)$ mVrms		$(800.0 \times CF + 8.35)$ mVrms
1.500 Vrms at 1.00 kHz	$(1.500 \times CF - 0.0154)$ Vrms		$(1.500 \times CF + 0.0154)$ Vrms
2.000 Vrms at 1.00 kHz	$(2.000 \times CF - 0.0204)$ Vrms		$(2.000 \times CF + 0.0204)$ Vrms
2.500 Vrms at 1.00 kHz	$(2.500 \times CF - 0.0254)$ Vrms		$(2.500 \times CF + 0.0254)$ Vrms

Frequency, Amplitude, DC Offset, and AC Flatness Test Record (cont.)

3.500 Vrms at 1.00 kHz

$(3.500 \times CF - 0.0354)$ Vrms

$(3.500 \times CF + 0.0354)$ Vrms

Frequency, Amplitude, DC Offset, and AC Flatness Test Record (cont.)

Amplitude (AFG325x / 325xC)

$$CF = 2 / (1 + 50 \Omega / \text{Measurement } \Omega) =$$

CH1 Amplitude	Minimum	Test result	Maximum
0.030 Vrms at 1.00 kHz	$(30.0 \times CF - 0.654)$ mVrms		$(30.0 \times CF + 0.654)$ mVrms
0.300 Vrms at 1.00 kHz	$(300.0 \times CF - 3.35)$ mVrms		$(300.0 \times CF + 3.35)$ mVrms
0.800 Vrms at 1.00 kHz	$(800.0 \times CF - 8.35)$ mVrms		$(800.0 \times CF + 8.35)$ mVrms
1.500 Vrms at 1.00 kHz	$(1.500 \times CF - 0.0154)$ Vrms		$(1.500 \times CF + 0.0154)$ Vrms
CH2 Amplitude	Minimum	Test result	Maximum
30.0 mVrms at 1.00 kHz	$(30.0 \times CF - 0.654)$ mVrms		$(30.0 \times CF + 0.654)$ mVrms
300.0 mVrms at 1.00 kHz	$(300.0 \times CF - 3.35)$ mVrms		$(300.0 \times CF + 3.35)$ mVrms
800.0 mVrms at 1.00 kHz	$(800.0 \times CF - 8.35)$ mVrms		$(800.0 \times CF + 8.35)$ mVrms
1.500 Vrms at 1.00 kHz	$(1.500 \times CF - 0.0154)$ Vrms		$(1.500 \times CF + 0.0154)$ Vrms

DC Offset (AFG3011 / 3011C)

$$CF = 2 / (1 + 50 \Omega / \text{Measurement } \Omega) =$$

CH1 DC Offset	Minimum	Test result	Maximum
+5.000 Vdc	$(+5.000 \times CF - 0.110)$ Vdc		$(+5.000 \times CF + 0.110)$ Vdc
0.000 Vdc	-0.010 Vdc		+0.010 Vdc
-5.000 Vdc	$(-5.000 \times CF - 0.110)$ Vdc		$(-5.000 \times CF + 0.110)$ Vdc

DC Offset (AFG302xB / 302xC / 305xC / 310x / 310xC)

$$CF = 2 / (1 + 50 \Omega / \text{Measurement } \Omega) =$$

CH1 DC Offset	Minimum	Test result	Maximum
+5.000 Vdc	$(+5.000 \times CF - 0.055)$ Vdc		$(+5.000 \times CF + 0.055)$ Vdc
0.000 Vdc	-0.005 Vdc		+0.005 Vdc
-5.000 Vdc	$(-5.000 \times CF - 0.055)$ Vdc		$(-5.000 \times CF + 0.055)$ Vdc
CH2 DC Offset	Minimum	Test result	Maximum
+5.000 Vdc	$(+5.000 \times CF - 0.055)$ Vdc		$(+5.000 \times CF + 0.055)$ Vdc
0.000 Vdc	-0.005 Vdc		+0.005 Vdc
-5.000 Vdc	$(-5.000 \times CF - 0.055)$ Vdc		$(-5.000 \times CF + 0.055)$ Vdc

DC Offset (AFG325x / 325xC)

$$CF = 2 / (1 + 50 \Omega / \text{Measurement } \Omega) =$$

CH1 DC Offset	Minimum	Test result	Maximum
+2.500 Vdc	$(+2.500 \times CF - 0.030)$ Vdc		$(+2.500 \times CF + 0.030)$ Vdc
0.000 Vdc	-0.005 Vdc		+0.005 Vdc
-2.500 Vdc	$(-2.500 \times CF - 0.030)$ Vdc		$(-2.500 \times CF + 0.030)$ Vdc
CH2 DC Offset	Minimum	Test result	Maximum

Frequency, Amplitude, DC Offset, and AC Flatness Test Record (cont.)

+2.500 Vdc	$(+2.500 \times CF - 0.030)$ Vdc	$(+2.500 \times CF + 0.030)$ Vdc
0.000 Vdc	-0.005 Vdc	+0.005 Vdc
-2.500 Vdc	$(-2.500 \times CF - 0.030)$ Vdc	$(-2.500 \times CF + 0.030)$ Vdc

Frequency, Amplitude, DC Offset, and AC Flatness Test Record (cont.)

AC Flatness (AFG3011 / 3011C)

CH1 AC Flatness	Minimum	Test result	Maximum
Frequency 100.00 kHz (Ampl: +4.0 dBm)	————	dB (= Reference)	————
Frequency 500.00 kHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 1.00 MHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 5.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 10.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB

AC Flatness (AFG302xB / 302xC)

CH1 AC Flatness	Minimum	Test result	Maximum
Frequency 100.00 kHz (Ampl: +4.0 dBm)	————	dB (= Reference)	————
Frequency 500.00 kHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 1.00 MHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 5.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 15.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 25.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB

CH2 AC Flatness

Frequency 100.00 kHz (Ampl: +4.0 dBm)	————	dB (= Reference)	————
Frequency 500.00 kHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 1.00 MHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 5.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 15.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 25.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB

AC Flatness (AFG305xC)

CH1 AC Flatness	Minimum	Test result	Maximum
Frequency 100.00 kHz (Ampl: +4.0 dBm)	————	dB (= Reference)	————
Frequency 500.00 kHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 1.00 MHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 5.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 10.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 15.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 25.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 50.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB

Frequency, Amplitude, DC Offset, and AC Flatness Test Record (cont.)

CH2 AC Flatness

Frequency	Reference -	dB (= Reference)	Reference +
Frequency 100.00 kHz (Ampl: +4.0 dBm)	-----		-----
Frequency 500.00 kHz	Reference - 0.15 dB	dB	Reference + 0.15 dB
Frequency 1.00 MHz	Reference - 0.15 dB	dB	Reference + 0.15 dB
Frequency 5.00 MHz	Reference - 0.30 dB	dB	Reference + 0.30 dB
Frequency 10.00 MHz	Reference - 0.30 dB	dB	Reference + 0.30 dB
Frequency 15.00 MHz	Reference - 0.30 dB	dB	Reference + 0.30 dB
Frequency 25.00 MHz	Reference - 0.30 dB	dB	Reference + 0.30 dB
Frequency 50.00 MHz	Reference - 0.50 dB	dB	Reference + 0.50 dB

Frequency, Amplitude, DC Offset, and AC Flatness Test Record (cont.)

AC Flatness (AFG310x / 310xC)

CH1 AC Flatness	Minimum	Test result	Maximum
Frequency 100.00 kHz (Ampl: +4.0 dBm)	————	dB (= Reference)	————
Frequency 1.00 MHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 5.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 25.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB
Frequency 50.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB
Frequency 100.0 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB

CH2 AC Flatness	Minimum	Test result	Maximum
Frequency 100.00 kHz (Ampl: +4.0 dBm)	————	dB (= Reference)	————
Frequency 1.00 MHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 5.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 25.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB
Frequency 50.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB
Frequency 100.0 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB

AC Flatness (AFG325x / 325xC)

CH1 AC Flatness	Minimum	Test result	Maximum
Frequency 100.00 kHz (Ampl: +4.0 dBm)	————	dB (= Reference)	————
Frequency 1.00 MHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 5.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 25.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB
Frequency 50.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB
Frequency 100.0 MHz	Reference - 1.00 dB		dB Reference + 1.00 dB
Frequency 150.00 MHz	Reference - 1.00 dB		dB Reference + 1.00 dB
Frequency 240.0 MHz	Reference - 2.00 dB		dB Reference + 2.00 dB

CH2 AC Flatness	Minimum	Test result	Maximum
Frequency 100.00 kHz (Ampl: +4.0 dBm)	————	dB (= Reference)	————
Frequency 1.00 MHz	Reference - 0.15 dB		dB Reference + 0.15 dB
Frequency 5.00 MHz	Reference - 0.30 dB		dB Reference + 0.30 dB
Frequency 25.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB
Frequency 50.00 MHz	Reference - 0.50 dB		dB Reference + 0.50 dB
Frequency 100.0 MHz	Reference - 1.00 dB		dB Reference + 1.00 dB
Frequency 150.00 MHz	Reference - 1.00 dB		dB Reference + 1.00 dB
Frequency 240.0 MHz	Reference - 2.00 dB		dB Reference + 2.00 dB

Harmonic Distortion Test Record

Harmonic Distortion (amplitude 1 V _{p-p})	Fundamental = reference	2nd	3rd	4th	5th	Limit
AFG3011 / 3011C						
Spectrum Analyzer reading						
Sine 20 kHz	20 kHz	40 kHz	60 kHz	80 kHz	100 kHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -55 dBc
Sine 100 kHz	100 kHz	200 kHz	300 kHz	400 kHz	500 kHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -55 dBc
Sine 1 MHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -45 dBc
Sine 10 MHz	10 MHz	20 MHz	35 MHz	40 MHz	50 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -45 dBc
AFG302xB / 302xC						
Spectrum Analyzer reading						
Sine 20 kHz	20 kHz	40 kHz	60 kHz	80 kHz	100 kHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -60 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -60 dBc
Sine 100 kHz	100 kHz	200 kHz	300 kHz	400 kHz	500 kHz	
CH1 Harmonic Distortion (dBc)						

Harmonic Distortion Test Record (cont.)

Harmonic Distortion (amplitude 1 V_{p-p})	Fundamental = reference	2nd	3rd	4th	5th	Limit
reading - reference (dBc)	0 dBc					Nth - reference < -60 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -60 dBc
Sine 1 MHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -50 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -50 dBc
Sine 25MHz	25 MHz	50 MHz	75 MHz	100 MHz	125 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -40 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -40 dBc
AFG305xC	Spectrum Analyzer reading					
Sine 20 kHz	20 kHz	40 kHz	60 kHz	80 kHz	100 kHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -60 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -60 dBc

Harmonic Distortion Test Record (cont.)

Harmonic Distortion (amplitude $1 V_{p-p}$)	Fundamental = reference	2nd	3rd	4th	5th	Limit
Sine 100 kHz	100 kHz	200 kHz	300 kHz	400 kHz	500 kHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -60 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -60 dBc
Sine 1 MHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -50 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -50 dBc
Sine 5 MHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -40 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -40 dBc
Sine 25 MHz	25 MHz	50 MHz	75 MHz	100 MHz	125 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -40 dBc
CH2 Harmonic Distortion (dBc)						

Harmonic Distortion Test Record (cont.)

Harmonic Distortion (amplitude 1 V _{p-p})	Fundamental = reference	2nd	3rd	4th	5th	Limit
reading - reference (dBc)	0 dBc					Nth - reference < -40 dBc
Sine 50 MHz	50 MHz	100 MHz	150 MHz	200 MHz	250 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -40 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -40 dBc
AFG310x / 310xC	Spectrum Analyzer reading					
Sine 1 MHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -50 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -50 dBc
Sine 5 MHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -37 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -37 dBc
Sine 25MHz	25 MHz	50 MHz	75 MHz	100 MHz	125 MHz	
CH1 Harmonic Distortion (dBc)						

Harmonic Distortion Test Record (cont.)

Harmonic Distortion (amplitude $1 V_{p-p}$)	Fundamental = reference	2nd	3rd	4th	5th	Limit
reading - reference (dBc)	0 dBc					Nth - reference < -37 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -37 dBc
Sine 100 MHz	100 MHz	200 MHz	300 MHz	400 MHz	500 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -37 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -37 dBc

Harmonic Distortion Test Record (cont.)

Harmonic Distortion (amplitude 1 V _{p-p})	Fundamental = reference	2nd	3rd	4th	5th	Limit
AFG325x	Spectrum Analyzer reading					
Sine 1 MHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -50 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -50 dBc
Sine 5 MHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc	dBc	dBc	dBc	dBc	Nth - reference < -37 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -37 dBc
Sine 100 MHz	100 MHz	200 MHz	300 MHz	400 MHz	500 MHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -30 dBc
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -30 dBc
Sine 240 MHz	240 MHz	480 MHz	720 MHz	960 MHz	1.20 GHz	
CH1 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -30 dBc

Harmonic Distortion Test Record (cont.)

Harmonic Distortion (amplitude 1 V _{p-p})	Fundamental = reference	2nd	3rd	4th	5th	Limit
CH2 Harmonic Distortion (dBc)						
reading - reference (dBc)	0 dBc					Nth - reference < -30 dBc

Total Harmonic Distortion (THD) Test Record

AFG3xxxx

Spectrum Analyzer reading

	Fundamental = reference	2nd	3rd	4th	5th	6th	7th	
Sine 20.0 kHz	20 kHz	40 kHz	60 kHz	80 kHz	100 kHz	120 kHz	140 kHz	
CH1 reading (dBm)	A ₁ =	A ₂ =	A ₃ =	A ₄ =	A ₅ =	A ₆ =	A ₇ =	
reading - reference (A _n - A ₁) (dBc)	B ₁ = 0	B ₂ =	B ₃ =	B ₄ =	B ₅ =	B ₆ =	B ₇ =	
C _n = 10 B _n /20	C ₁ = 1	C ₂ =	C ₃ =	C ₄ =	C ₅ =	C ₆ =	C ₇ =	
$THD = \frac{\sqrt{\sum_{n=2} C_n^2}}{C_1}$								Limit < 0.2%
CH2 reading (dBm)	A ₁ =	A ₂ =	A ₃ =	A ₄ =	A ₅ =	A ₆ =	A ₇ =	
reading - reference (A _n - A ₁) (dBc)	B ₁ = 0	B ₂ =	B ₃ =	B ₄ =	B ₅ =	B ₆ =	B ₇ =	
C _n = 10 B _n /20	C ₁ = 1	C ₂ =	C ₃ =	C ₄ =	C ₅ =	C ₆ =	C ₇ =	
$THD = \frac{\sqrt{\sum_{n=2} C_n^2}}{C_1}$								Limit < 0.2%

Spurious Test Record (AFG3011 / 3011C)

Spectrum Analyzer				Measurement		
Frequency	Center Frequency	Span	RBW	Spurious Frequency	Spurious (Max)	Limit
CH1 Spurious						
Sine 100 kHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -60 dBc
Sine 1.00 MHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 10.00 MHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -50 dBc

Spurious Test Record (AFG302xB / 302XC)

Spectrum Analyzer				Measurement		
Frequency	Center Frequency	Span	RBW	Spurious Frequency	Spurious (Max)	Limit
CH1 Spurious						
Sine 100 kHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -60 dBc
Sine 1.00 MHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 10.00 MHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 25.00 MHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -50 dBc
CH2 Spurious						
Sine 100 kHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -60 dBc
Sine 1.00 MHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 10.00 MHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 25.00 MHz	10 MHz / 300 MHz	20 MHz / 600 MHz	20 kHz / 20 kHz	MHz MHz	dBc dBc	< -50 dBc

Spurious Test Record (AFG305xC)

Spectrum Analyzer				Measurement		
Frequency	Center Frequency	Span	RBW	Spurious Frequency	Spurious (Max)	Limit

Spurious Test Record (AFG305xC) (cont.)

CH1 Spurious

Sine 100 kHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -60 dBc
Sine 1.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 10.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 25.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 50.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc

CH2 Spurious

Sine 100 kHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -60 dBc
Sine 1.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 10.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 25.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 50.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc

Spurious Test Record (AFG310x / 310xC)

Spectrum Analyzer				Measurement		
Frequency	Center Frequency	Span	RBW	Spurious Frequency	Spurious (Max)	Limit
CH1 Spurious						
Sine 100 kHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -60 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 1.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 10.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 25.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 50.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -44 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 100.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -38 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
CH2 Spurious						
Sine 100 kHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -60 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 1.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 10.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 25.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 50.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -44 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
Sine 100.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -38 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	

Spurious Test Record (AFG325x / 325xC)

CH1 Spurious

Sine 100 kHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 1.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -47 dBc
Sine 10.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -47 dBc
Sine 25.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -47 dBc
Sine 50.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -41 dBc
Sine 100.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -35 dBc
Sine 200.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -29 dBc
Sine 240.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -28 dBc

CH2 Spurious

Sine 100 kHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -50 dBc
Sine 1.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -47 dBc
Sine 10.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -47 dBc
Sine 25.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -47 dBc
Sine 50.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -41 dBc
Sine 100.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -35 dBc
Sine 200.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -29 dBc
Sine 240.00 MHz	10 MHz 300 MHz	20 MHz 600 MHz	20 kHz 20 kHz	MHz MHz	dBc dBc	< -28 dBc

Rise/Fall Time Test Record

AFG3011 / 3011C

CH1

Rise Time Amplitude: 1.0 Vpp	-----	50 ns
Fall Time Amplitude: 1.0 Vpp	-----	50 ns
Rise Time Amplitude: 10.0 Vpp	-----	50 ns

Rise/Fall Time Test Record (cont.)

Fall Time Amplitude: 10.0 Vpp	-----	50 ns
-------------------------------	-------	-------

AFG302xB / 302xC**CH1**

Rise Time Amplitude: 1.0 Vpp	-----	9 ns
------------------------------	-------	------

Fall Time Amplitude: 1.0 Vpp	-----	9 ns
------------------------------	-------	------

Rise Time Amplitude: 10.0 Vpp	-----	9 ns
-------------------------------	-------	------

Fall Time Amplitude: 10.0 Vpp	-----	9 ns
-------------------------------	-------	------

CH2

Rise Time Amplitude: 1.0 Vpp	-----	9 ns
------------------------------	-------	------

Fall Time Amplitude: 1.0 Vpp	-----	9 ns
------------------------------	-------	------

Rise Time Amplitude: 10.0 Vpp	-----	9 ns
-------------------------------	-------	------

Fall Time Amplitude: 10.0 Vpp	-----	9 ns
-------------------------------	-------	------

AFG305xC**CH1**

Rise Time Amplitude: 1.0 Vpp	-----	7 ns
------------------------------	-------	------

Fall Time Amplitude: 1.0 Vpp	-----	7 ns
------------------------------	-------	------

Rise Time Amplitude: 10.0 Vpp	-----	7 ns
-------------------------------	-------	------

Fall Time Amplitude: 10.0 Vpp	-----	7 ns
-------------------------------	-------	------

CH2

Rise Time Amplitude: 1.0 Vpp	-----	7 ns
------------------------------	-------	------

Fall Time Amplitude: 1.0 Vpp	-----	7 ns
------------------------------	-------	------

Rise Time Amplitude: 10.0 Vpp	-----	7 ns
-------------------------------	-------	------

Fall Time Amplitude: 10.0 Vpp	-----	7 ns
-------------------------------	-------	------

AFG310x / 310xC**CH1**

Rise Time Amplitude: 1.0 Vpp	-----	5 ns
------------------------------	-------	------

Fall Time Amplitude: 1.0 Vpp	-----	5 ns
------------------------------	-------	------

Rise Time Amplitude: 10.0 Vpp	-----	5 ns
-------------------------------	-------	------

Fall Time Amplitude: 10.0 Vpp	-----	5 ns
-------------------------------	-------	------

CH2

Rise Time Amplitude: 1.0 Vpp	-----	5 ns
------------------------------	-------	------

Fall Time Amplitude: 1.0 Vpp	-----	5 ns
------------------------------	-------	------

Rise Time Amplitude: 10.0 Vpp	-----	5 ns
-------------------------------	-------	------

Fall Time Amplitude: 10.0 Vpp	-----	5 ns
-------------------------------	-------	------

Rise-Fall Time

AFG325x / 325xC**CH1**

Rise Time Amplitude: 1.0 Vpp	-----	2.5 ns
------------------------------	-------	--------

Rise/Fall Time Test Record (cont.)

Fall Time Amplitude: 1.0 Vpp	-----	2.5 ns
Rise Time Amplitude: 5.0 Vpp	-----	2.5 ns
Fall Time Amplitude: 5.0 Vpp	-----	2.5 ns
CH2		
Rise Time Amplitude: 1.0 Vpp	-----	2.5 ns
Fall Time Amplitude: 1.0 Vpp	-----	2.5 ns
Rise Time Amplitude: 5.0 Vpp	-----	2.5 ns
Fall Time Amplitude: 5.0 Vpp	-----	2.5 ns

Frequency/period test

This test verifies the frequency accuracy of the arbitrary function generator. All output frequencies are derived from a single generated frequency. Only one frequency point of channel 1 is required to be checked.

1. Connect the arbitrary function generator to the frequency counter as shown in the following figure.

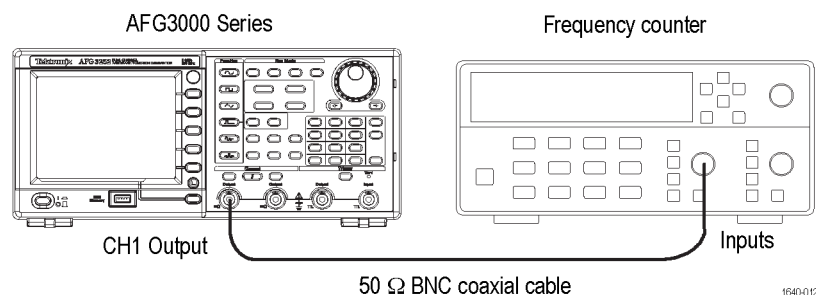


Figure 3: Frequency/period test

2. Push the Default front-panel button and the OK menu button to recall the arbitrary function generator default setup.
3. Set up the arbitrary function generator using the following steps:

Select menu	Setting	Operation
Function	Sine	Sine (front)
Frequency	1.000000 MHz	Frequency/Period (front)
Amplitude	1.00 Vpp	Amplitude/High (front)
Channel 1 Output	On	On (front)

4. Check that reading of the Frequency Counter is between 0.999999 MHz and 1.000001 MHz.
5. Set up the arbitrary function generator using the following steps:

Select menu	Setting	Operation
Function	Pulse	Pulse (front)

6. Check that reading of the frequency counter is between 0.999999 MHz and 1.000001 MHz.

Amplitude test

This test verifies the amplitude accuracy of the arbitrary function generator. All output amplitudes are derived from a combination of attenuators and 3 dB variable gain. Some amplitude points are checked. This test uses a 50 Ω terminator. It is necessary to know the accuracy of the 50 Ω terminator in advance of this amplitude test. This accuracy is used as a calibration factor.

1. Connect the 50 Ω terminator to the DMM as shown in the following figure and measure the register value.

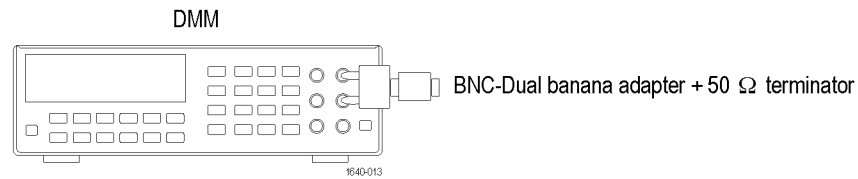


Figure 4: 50 Ω terminator accuracy

2. Calculate the 50 Ω calibration factor (CF) from the reading value and record as follows:

$$\text{CF (Calibration Factor)} = 2 / (1 + 50 \Omega / \text{Measurement } \Omega)$$

Measurement (reading of the DMM) Ω	CF
Examples	
50.50 Ω	1.0050 (= 2 / (1 + 50 / 50.50))
49.62 Ω	0.9962 (= 2 / (1 + 50 / 49.62))

3. Connect the arbitrary function generator to the DMM as shown in the following figure. Be sure to connect the 50 Ω terminator to the arbitrary function generator Output connector side.

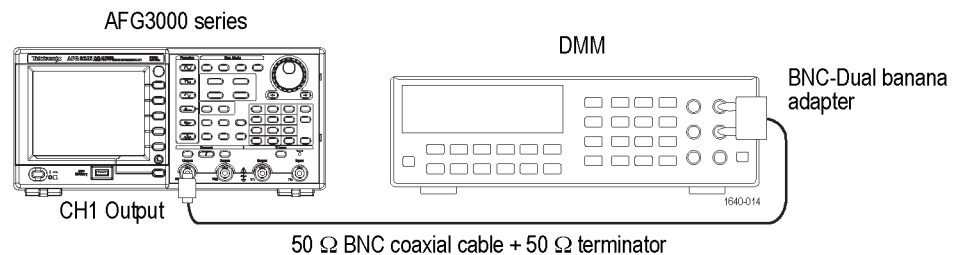


Figure 5: Amplitude test

4. Set up the arbitrary function generator using the following steps:

Select menu	Setting	Operation
Function	Sine	Sine (front)
Frequency	1.000000 kHz	Frequency/Period (front)
Amplitude Units	V rms The voltage unit should be matched to that of DMM.	Top Menu > Amplitude/Level Menu > -more- > Units > V rms
Amplitude	0.030 Vrms	Amplitude/High (front)
Channel 1 Output	On	On (front)

5. Verify that each amplitude measurement is within the range specified in the following tables.
6. (Two channel models only) Repeat steps 3 through 4 for the channel 2 output.

AFG3011 / 3011C

Function	Frequency	Amplitude	Measurement	Range
Sine	1.000 kHz	30.0 mVrms	mVrms	$(30.0 \times CF \pm 1.307)$ mVrms
Sine	1.000 kHz	300.0 mVrms	mVrms	$(300.0 \times CF \pm 6.71)$ mVrms
Sine	1.000 kHz	800.0 mVrms	mVrms	$(800.0 \times CF \pm 16.71)$ mVrms
Sine	1.000 kHz	1.500 Vrms	Vrms	$(1.500 \times CF \pm 0.0307)$ Vrms
Sine	1.000 kHz	2.000 Vrms	Vrms	$(2.000 \times CF \pm 0.0407)$ Vrms
Sine	1.000 kHz	2.500 Vrms	Vrms	$(2.500 \times CF \pm 0.0507)$ Vrms
Sine	1.000 kHz	3.500 Vrms	Vrms	$(3.500 \times CF \pm 0.0707)$ Vrms

AFG302xB / 302xC / 305xC / 310x / 310xC

Function	Frequency	Amplitude	Measurement	Range
Sine	1.000 kHz	30.0 mVrms	mVrms	$(30.0 \times CF \pm 0.654)$ mVrms
Sine	1.000 kHz	300.0 mVrms	mVrms	$(300.0 \times CF \pm 3.35)$ mVrms
Sine	1.000 kHz	800.0 mVrms	mVrms	$(800.0 \times CF \pm 8.35)$ mVrms
Sine	1.000 kHz	1.500 Vrms	Vrms	$(1.500 \times CF \pm 0.0154)$ Vrms
Sine	1.000 kHz	2.000 Vrms	Vrms	$(2.000 \times CF \pm 0.0204)$ Vrms
Sine	1.000 kHz	2.500 Vrms	Vrms	$(2.500 \times CF \pm 0.0254)$ Vrms
Sine	1.000 kHz	3.500 Vrms	Vrms	$(3.500 \times CF \pm 0.0354)$ Vrms

AFG325x / 325xC

Function	Frequency	Amplitude	Measurement	Range
Sine	1.000 kHz	30.0 mVrms	mVrms	$(30.0 \times CF \pm 0.654)$ mVrms
Sine	1.000 kHz	300.0 mVrms	mVrms	$(300.0 \times CF \pm 3.35)$ mVrms
Sine	1.000 kHz	800.0 mVrms	mVrms	$(800.0 \times CF \pm 8.35)$ mVrms
Sine	1.000 kHz	1.500 Vrms	Vrms	$(1.500 \times CF \pm 0.0154)$ Vrms

DC Offset test

This test verifies the DC offset accuracy of the arbitrary function generator. This test uses a 50 Ω terminator. It is necessary to know the accuracy of a 50 Ω terminator in advance of this test. This accuracy is used for as a calibration factor.

1. Connect the 50 Ω terminator to the DMM as shown in the following figure and measure the register value.

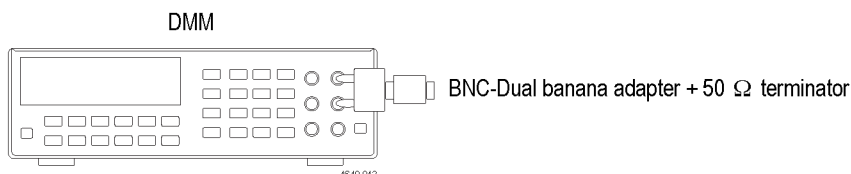


Figure 6: 50 Ω terminator accuracy

2. Calculate the 50 Ω calibration factor (CF) from the reading value and record as follows:

$$CF \text{ (Calibration Factor)} = 2 / (1 + 50 \Omega / \text{Measurement } \Omega)$$

Measurement (reading of the DMM) Ω	CF
Examples	
50.50 Ω	1.0050 (= 2 / (1 + 50 / 50.50))
49.62 Ω	0.9962 (= 2 / (1 + 50 / 49.62))

3. Connect the arbitrary function generator to the DMM as shown in the following figure. Be sure to connect the 50 Ω terminator to the arbitrary function generator Output connector side.

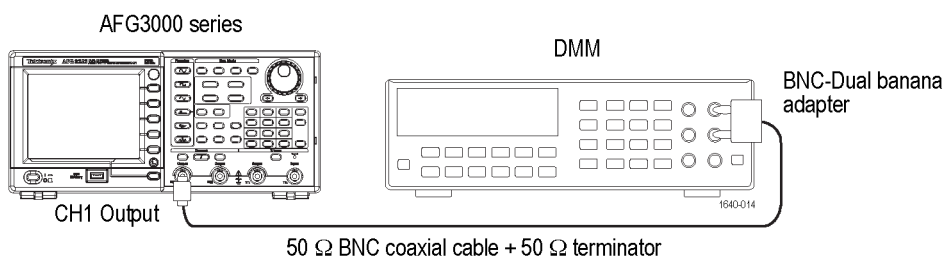


Figure 7: DC offset tests

4. Set up the arbitrary function generator using the following steps:

Select menu	Setting	Operation
Function	DC	More... (front) > More Waveform Menu > DC
Offset	+ 5.000 V + 2.500 V (AFG325x)	Offset/Low (front)
Channel 1 Output	On	On (front)

5. Verify that each offset measurement is within the range specified in the following tables.
6. (Two channel models only) Repeat steps 3 through 4 for the channel 2 output.

AFG3011 / 3011C

Function	Offset	Measurement	Range
DC	+ 5.000 Vdc	Vdc	$(5.000 \times CF \pm 0.110)$ Vdc
DC	0.000 Vdc	Vdc	± 0.010 Vdc
DC	- 5.000 Vdc	Vdc	$(- 5.000 \times CF \pm 0.110)$ Vdc

AFG302xB / 302xC / 305xC / 310x / 310xC

Function	Offset	Measurement	Range
DC	+ 5.000 Vdc	Vdc	$(5.000 \times CF \pm 0.055)$ Vdc
DC	0.000 Vdc	Vdc	± 0.005 Vdc
DC	- 5.000 Vdc	Vdc	$(- 5.000 \times CF \pm 0.055)$ Vdc

AFG325x / 325xC

Function	Offset	Measurement	Range
DC	+ 2.500 Vdc	Vdc	$(2.500 \times CF \pm 0.030)$ Vdc
DC	0.000 Vdc	Vdc	± 0.005 Vdc
DC	- 2.500 Vdc	Vdc	$(- 2.500 \times CF \pm 0.030)$ Vdc

AC Flatness test

This test verifies the flatness of a sine wave to 100 kHz sine wave.

1. Connect the arbitrary function generator to the power meter with a power head as shown in the following figure.

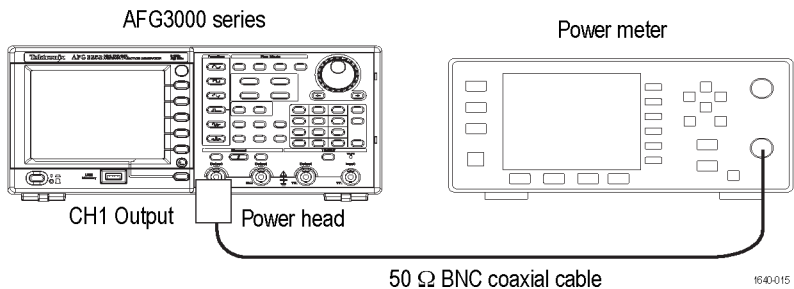


Figure 8: AC flatness tests

2. Set up the arbitrary function generator using the following steps:

Select menu	Setting	Operation
Function	Sine	Sine (front)
Frequency	100.0000 kHz	Frequency/Period (front)
Amplitude Units	dBm	TopMenu > Amplitude/Level Menu > -more- > Units > dBm
Amplitude	+ 4.0 dBm	Amplitude/High (front)
Channel 1 Output	On	On (front)

3. Set the frequency of the Power Meter to 100 kHz.
4. Write the Power Meter reading of the 100 kHz sine wave as a reference power value.
5. Verify that the power measurement at each frequency is within the error specified in the following tables.
6. (Two channel models only) Repeat steps 3 through 4 for the channel 2 output.

AFG3011 / 3011C			Measurement	Range
Function	Amplitude	Frequency	(dB)	(dB)
Sine	+ 4.0 dBm	100.00 kHz	= Reference	-----
Sine	+ 4.0 dBm	500.00 kHz		Reference \pm 0.15
Sine	+ 4.0 dBm	1.00 MHz		Reference \pm 0.15
Sine	+ 4.0 dBm	5.00 MHz		Reference \pm 0.30
Sine	+ 4.0 dBm	10.00 MHz		Reference \pm 0.30

AFG302xB / 302xC			Measurement	Range
Function	Amplitude	Frequency	(dB)	(dB)
Sine	+ 4.0 dBm	100.00 kHz	= Reference	-----
Sine	+ 4.0 dBm	500.00 kHz		Reference \pm 0.15
Sine	+ 4.0 dBm	1.00 MHz		Reference \pm 0.15
Sine	+ 4.0 dBm	5.00 MHz		Reference \pm 0.30
Sine	+ 4.0 dBm	15.00 MHz		Reference \pm 0.30
Sine	+ 4.0 dBm	25.00 MHz		Reference \pm 0.50

AFG305xC			Measurement	Range
Function	Amplitude	Frequency	(dB)	(dB)
Sine	+ 4.0 dBm	100.00 kHz	= Reference	-----
Sine	+ 4.0 dBm	500.00 kHz		Reference \pm 0.15
Sine	+ 4.0 dBm	1.00 MHz		Reference \pm 0.15
Sine	+ 4.0 dBm	5.00 MHz		Reference \pm 0.30
Sine	+ 4.0 dBm	15.00 MHz		Reference \pm 0.30

Performance verification

AFG305xC			Measurement	Range
Sine	+ 4.0 dBm	25.00 MHz		Reference \pm 0.30
Sine	+ 4.0 dBm	50.00 MHz		Reference \pm 0.50

AFG310x / 310xC			Measurement	Range
Function	Amplitude	Frequency	(dB)	(dB)
Sine	+ 4.0 dBm	100.00 kHz	= Reference	-----
Sine	+ 4.0 dBm	1.00 MHz		Reference \pm 0.15
Sine	+ 4.0 dBm	5.00 MHz		Reference \pm 0.30
Sine	+ 4.0 dBm	25.00 MHz		Reference \pm 0.50
Sine	+ 4.0 dBm	50.00 MHz		Reference \pm 0.50
Sine	+ 4.0 dBm	100.00 MHz		Reference \pm 0.50

AFG325x / 325xC			Measurement	Range
Function	Amplitude	Frequency	(dB)	(dB)
Sine	+ 4.0 dBm	100.00 kHz	= Reference	-----
Sine	+ 4.0 dBm	1.00 MHz		Reference \pm 0.15
Sine	+ 4.0 dBm	5.00 MHz		Reference \pm 0.30
Sine	+ 4.0 dBm	25.00 MHz		Reference \pm 0.50
Sine	+ 4.0 dBm	50.00 MHz		Reference \pm 0.50
Sine	+ 4.0 dBm	100.00 MHz		Reference \pm 1.00
Sine	+ 4.0 dBm	150.00 MHz		Reference \pm 1.00
Sine	+ 4.0 dBm	240.00 MHz		Reference \pm 2.00

Harmonics Distortion test

This test verifies the harmonic distortion using a spectrum analyzer.

1. Connect the arbitrary function generator to the spectrum analyzer as shown in the following figure.

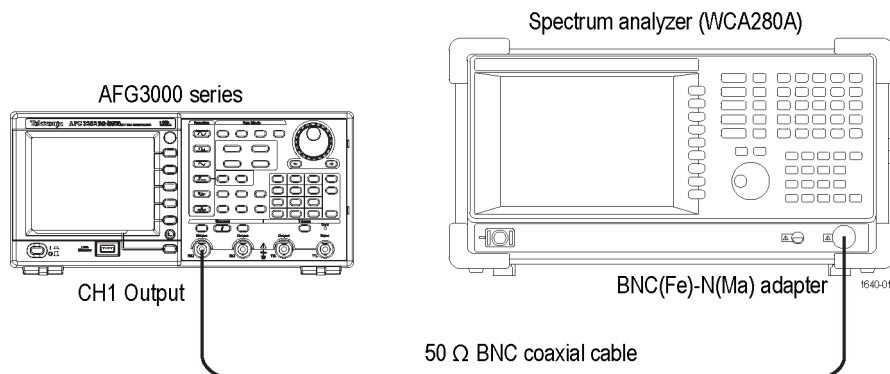


Figure 9: Harmonic distortion tests

2. Push the Default front-panel button and OK menu button to recall the arbitrary function generator default setup.
3. Set up the arbitrary function generator using the following steps:

Select menu	Setting	Operation
Function	Sine	Sine (front)
Frequency	20.00 kHz: AFG3011 / 3011C / 302xB / 302xC / 305xC 1.000 MHz: AFG310x / 310xC / 325x / 325xC	Frequency/Period (front)
Amplitude Units	Vpp	TopMenu > Amplitude/Level Menu > -more- > Units > Vpp
Amplitude	1.00 Vpp	Amplitude/High (front)
Channel 1 Output	On	On (front)

4. Set up the spectrum analyzer according the frequency setup of the arbitrary function generator.
5. Set the Ref Level of the spectrum analyzer to 8 dBm.
6. Read the signal level in the Fundamental frequency for each signal. Use this level as a Reference value in step .
7. Verify that the differences between the reference level and the signal level in the frequency of higher-order at each frequency are below the limit specified in the following tables.
8. (Two channel models only) Repeat steps 2 through 4 for the channel 2 output.

Performance verification

AFG3011 / 3011C		Spectrum Analyzer			Measurement					Limit
Frequency	Center Frequency	Span	RBW	Fundamental (= Reference)	2nd	3rd	4th	5th	Nth - Reference	
20.00 kHz	100 kHz	200 kHz	500 Hz	20 kHz	40 kHz	60 kHz	80 kHz	100 kHz	< -55 dBc	
100.00 kHz	500 kHz	1 MHz	2 kHz	100 kHz	200 kHz	300 kHz	400 kHz	500 kHz	< -55 dBc	
1.00 MHz	5.00 MHz	10 MHz	20 kHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	< -45 dBc	
10.00 MHz	10 MHz/ 50 MHz	20 MHz/ 100 MHz	20 kHz/ 20 kHz	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz	< -45dBc	

AFG302xB / 302xC		Spectrum Analyzer			Measurement					Limit
Frequency	Center Frequency	Span	RBW	Fundamental (= Reference)	2nd	3rd	4th	5th	Nth - Reference	
20.00 kHz	100 kHz	200 kHz	500 Hz	20 kHz	40 kHz	60 kHz	80 kHz	100 kHz	< -60 dBc	
100.00 kHz	500 kHz	1 MHz	2 kHz	100 kHz	200 kHz	300 kHz	400 kHz	500 kHz	< -60 dBc	
1.00 MHz	5.00 MHz	10 MHz	20 kHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	< -50 dBc	
25.00 MHz	125 MHz	250 MHz	20 kHz	25 MHz	50 MHz	75 MHz	100 MHz	125 MHz	< -40 dBc	

AFG305xC		Spectrum Analyzer			Measurement					Limit
Frequency	Center Frequency	Span	RBW	Fundamental (= Reference)	2nd	3rd	4th	5th	Nth - Reference	
100 kHz	500 kHz	1 MHz	2 kHz	100 kHz	200 kHz	300 kHz	400 kHz	500 kHz	< -60 dBc	
1 MHz	5.00 MHz	10 MHz	20 kHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	< -50 dBc	
10 MHz	10 MHz / 25 MHz	20 MHz / 50 MHz	20 kHz / 20 kHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	< -37 dBc	
25 MHz	125 MHz	250 MHz	20 kHz	25 MHz	50 MHz	75 MHz	100 MHz	125 MHz	< -37 dBc	
50 MHz	500 MHz	1 GHz	100 kHz	100 MHz	200 MHz	300 MHz	400 MHz	500 MHz	< -37 dBc	

AFG310x / 310xC		Spectrum Analyzer			Measurement					Limit
Frequency	Center Frequency	Span	RBW	Fundamental (= Reference)	2nd	3rd	4th	5th	Nth - Reference	
1 MHz	5.00 MHz	10 MHz	20 kHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	< -50 dBc	
5 MHz	10 MHz / 25 MHz	20 MHz / 50 MHz	20 kHz / 20 kHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	< -37 dBc	
25 MHz	125 MHz	250 MHz	20 kHz	25 MHz	50 MHz	75 MHz	100 MHz	125 MHz	< -37 dBc	
100 MHz	500 MHz	1 GHz	100 kHz	100 MHz	200 MHz	300 MHz	400 MHz	500 MHz	< -37 dBc	

AFG325x / 325xC	Spectrum Analyzer			Measurement					Limit
	Frequency	Center Frequency	Span	RBW	Fundamental (= Reference)	2nd	3rd	4th	
1 MHz	5.00 MHz	10 MHz	20 kHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	< -50 dBc
5 MHz	10 MHz / 25 MHz	20 MHz / 50 MHz	20 kHz / 20 kHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	< -37 dBc
100 MHz	500 MHz	1 GHz	100 kHz	100 MHz	200 MHz	300 MHz	400 MHz	500 MHz	< -30 dBc
240 MHz	625 MHz	1.25 GHz	100 kHz	240 MHz	480 MHz	720 MHz	960 MHz	1.20 GHz	< -30 dBc

Total Harmonic Distortion test

This test verifies the total harmonic distortion (THD) using a spectrum analyzer.

1. Connect the arbitrary function generator to the spectrum analyzer as shown in the following figure.

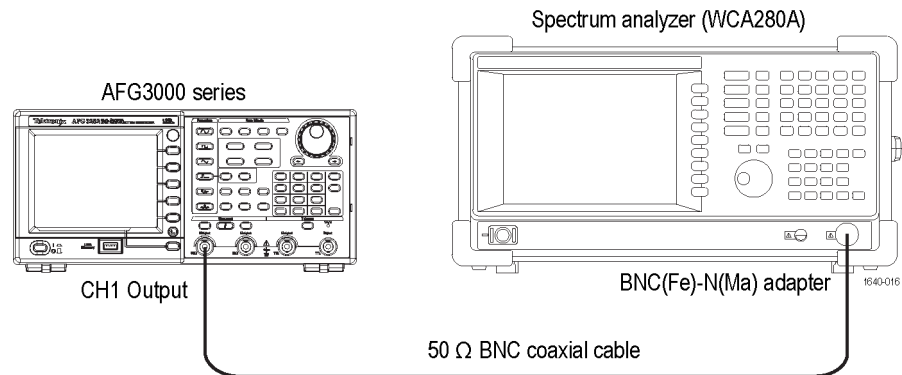


Figure 10: Total Harmonic distortion tests

2. Set up the arbitrary function generator using the following steps:

Select menu	Setting	Operation
Function	Sine	Sine (front)
Frequency	20.00 kHz	Frequency/Period (front)
Amplitude Units	Vpp	TopMenu > Amplitude/Level Menu > -more- > Units > Vpp
Amplitude	1.00 Vpp	Amplitude/High (front)
Channel 1 Output	On	On (front)

3. Set up the spectrum analyzer according to the following table:

Center Frequency	Span	RBW
100 kHz	200 kHz	500 Hz

- Set the Ref Level of the spectrum analyzer to 8 dBm.
- When the THD cannot be measured directly, it is obtained by using the following calculation:

$$THD = \frac{\sqrt{\sum_{n=2} C_n^2}}{C_1}$$

- Measure and record each level (A1 to A7) to the seventh harmonics of the 20 kHz sine wave.
- Calculate the each B1 to B7, C1 to C7 value and the THD using the following table.

NOTE. When all the harmonic components are -62 dBm or less, the calculation of THD can be skipped because it is $THD < 0.2\%$.

- Verify that the THD is less than 0.2%.
- (Two channel models only) Repeat steps 2 through 4 for the channel 2 output.

AFG3xxxx		Measurement						
Function	Frequency	Fundamental = reference	2nd	3rd	4th	5th	6th	7th
sine	20.00 kHz	20 kHz	40 kHz	60 kHz	80 kHz	100 kHz	120 kHz	140 kHz
reading (dBm)		A1 =	A2 =	A3 =	A4 =	A5 =	A6 =	A7 =
reading - reference Bn = An - A1 (dBc)		B1 = 0	B2 =	B3 =	B4 =	B5 =	B6 =	B7 =
Cn = 10 Bn/20		C1 = 1	C2 =	C3 =	C4 =	C5 =	C6 =	C7 =
$THD = \frac{\sqrt{\sum_{n=2} C_n^2}}{C_1}$		THD =						Limit < 0.2%
Sample: reading		1.5 dBm	-58.5 dBm	-58.5 dBm	-63.5 dBm	-58.5 dBm	-63.5 dBm	-63.5 dBm
reading - reference		0	-60 dBm	-60 dBm	-65 dBm	-60 dBm	-65 dBm	-65 dBm
Cn =		1.000	0.001	0.001	0.000562	0.001	0.000562	0.000562
$THD = \frac{\sqrt{\sum_{n=2} C_n^2}}{C_1}$		0.1987%						Limit < 0.2%

Spurious test

This test verifies the spurious using a spectrum analyzer.

1. Connect the arbitrary function generator to the spectrum analyzer as shown in the following figure.

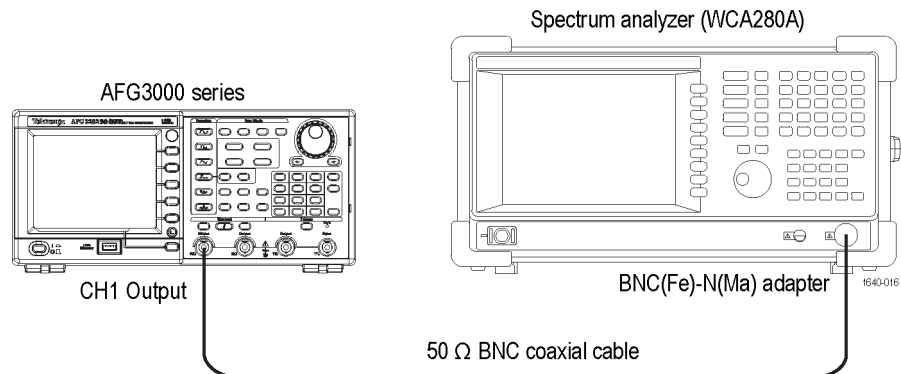


Figure 11: Spurious tests

2. Set up the arbitrary function generator using the following steps:

Select menu	Setting	Operation
Function	Sine	Sine (front)
Frequency	100.00 kHz	Frequency/Period (front)
Amplitude Units	Vpp	TopMenu > Amplitude/Level Menu > -more- > Units > Vpp
Amplitude	1.00 Vpp	Amplitude/High (front)
Channel 1 Output	On	On (front)

3. Set the center frequency of the spectrum analyzer to 10 MHz. Other settings are shown in the following tables.
4. Set the Ref Level of the spectrum analyzer to 8 dBm.
5. Measure the maximum spurious level other than harmonic distortion of 1 Vpp sine wave in each frequency.
6. Set the center frequency of the spectrum analyzer to 300 MHz. Other settings are shown in the following tables.
7. Measure the maximum spurious level other than harmonic distortion of 1 Vpp sine wave in each frequency.
8. Verify that the spurious signal at each frequency is equal to or less than the limit specified in the following tables.
9. (Two channel models only) Repeat steps 2 through 8 for the channel 2 output.

Performance verification

**AFG3011 /
3011C**

Spectrum analyzer				Measurement		
Frequency	Center Frequency	Span	RBW	Spurious Frequency	Spurious (Max)	Limit
100.00 kHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -60 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
1.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
10.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	

**AFG302xB /
302xC**

Spectrum analyzer				Measurement		
Frequency	Center Frequency	Span	RBW	Spurious Frequency	Spurious (Max)	Limit
100.00 kHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -60 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
1.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
10.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
25.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	

AFG305xC

Spectrum analyzer				Measurement		
Frequency	Center Frequency	Span	RBW	Spurious Frequency	Spurious (Max)	Limit
100.00 kHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -60 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
1.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
10.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
25.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	
50.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	

**AFG310x /
310xC**

Spectrum analyzer				Measurement		
Frequency	Center Frequency	Span	RBW	Spurious Frequency	Spurious (Max)	Limit
100.00 kHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -60 dBc
	300 MHz	600 MHz	20 kHz	MHz	dBc	

AFG310x / 310xC		Spectrum analyzer			Measurement		
1.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
10.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
25.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
50.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -44 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
100.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -38 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		

AFG325x / 325xC		Spectrum analyzer			Measurement		
Frequency	Center Frequency	Span	RBW	Spurious Frequency	Spurious (Max)	Limit	
100.00 kHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -50 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
1.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -47 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
10.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -47 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
25.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -47 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
50.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -41 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
100.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -35 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
200.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -29 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		
240.00 MHz	10 MHz	20 MHz	20 kHz	MHz	dBc	< -28 dBc	
	300 MHz	600 MHz	20 kHz	MHz	dBc		

Rise-Fall time test

This test verifies the pulse rise time of the arbitrary function generator.

1. Connect the arbitrary function generator to the oscilloscope as shown in the following figure.

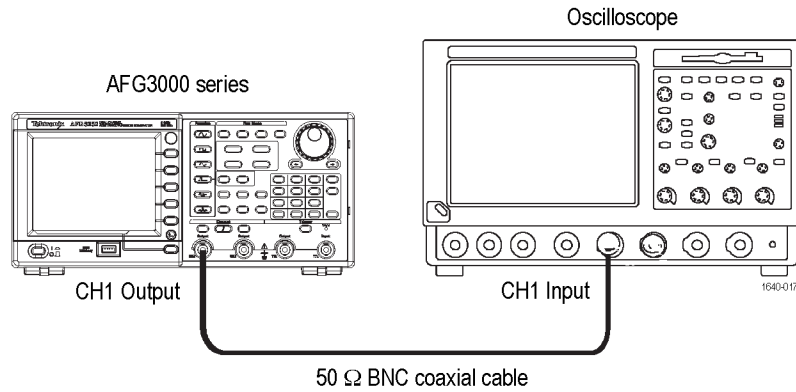


Figure 12: Rise-Fall time tests

2. Set up the arbitrary function generator using the following steps:

Select menu	Setting	Operation
Function	Square	Square (front)
Frequency	2.00 MHz: AFG3011 / 3011C 10.00 MHz: AFG302xB / 302xC / 305xC / 310x / 310xC / 325x / 325xC	Frequency/Period (front)
Amplitude Units	Vpp	TopMenu > Amplitude/Level Menu > -more- > Units > Vpp
Amplitude	1.0 Vpp	Amplitude/High (front)
Offset	0.0 V	TopMenu > Offset/Low (front)
Channel 1 Output	On	On (front)

3. Set up the Oscilloscope so the square waveform of 5 division amplitude is displayed.
4. Verify that the rise/fall time of the square waveform on the oscilloscope at each amplitude is equal to or less than the limit specified in the following tables. Use 10-90% reference level for rise/fall time measurement.
5. (Two channel models only) Repeat steps 2 through 4 for the channel 2 output.

AFG3011 / 3011C				Oscilloscope		Measurement
Function	Frequency	Offset	Amplitude	Vertical	Horizontal	Limit
Square	2.00 MHz	0.0 V	1.0 Vpp	200 mV/div	20 ns/div or 25 ns/div	≤ 50 ns
Square	2.00 MHz	0.0 V	10.0 Vpp	200 mV/div with x10 attenuator	20 ns/div or 25 ns/div	≤ 50 ns

AFG302xB / 302xC				Oscilloscope		Measurement
Function	Frequency	Offset	Amplitude	Vertical	Horizontal	Limit
Square	10.00 MHz	0.0 V	1.0 Vpp	200 mV/div	5 ns/div	≤ 9 ns
Square	10.00 MHz	0.0 V	10.0 Vpp	200 mV/div with x10 attenuator	5 ns/div	≤ 9 ns

AFG305xC				Oscilloscope		Measurement
Function	Frequency	Offset	Amplitude	Vertical	Horizontal	Limit
Square	10.00 MHz	0.0 V	1.0 Vpp	200 mV/div	5 ns/div	≤ 7 ns
Square	10.00 MHz	0.0 V	10.0 Vpp	200 mV/div with x10 attenuator	5 ns/div	≤ 7 ns

AFG310x / 310xC				Oscilloscope		Measurement
Function	Frequency	Offset	Amplitude	Vertical	Horizontal	Limit
Square	10.00 MHz	0.0 V	1.0 Vpp	200 mV/div	2 ns/div	≤ 5 ns
Square	10.00 MHz	0.0 V	10.0 Vpp	200 mV/div with x10 attenuator	2 ns/div	≤ 5 ns

AFG325x / 325xC				Oscilloscope		Measurement
Function	Frequency	Offset	Amplitude	Vertical	Horizontal	Limit
Square	10.00 MHz	0.0 V	1.0 Vpp	200 mV/div	1 ns/div	≤ 2.5 ns
Square	10.00 MHz	0.0 V	5.0 Vpp	1.0 V/div	1 ns/div	≤ 2.5 ns