Keysight Infiniium UXR-Series Real-Time Oscilloscopes

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User's Guide

Notices

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Technology License

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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

For more safety information, refer to Chapter 6 in this guide and to the *For Your Safety* leaflet.

Infiniium UXR Real-Time Oscilloscopes—At a Glance

Table 1 Infiniium UXR real-time oscilloscopes

Model	Bandwidth, Sample rate	# of channels	Input connector type
UXR1104A, UXR1102A	110 GHz, 256 Gsa/s	4,2	1.0 mm
UXR1004A, UXR1002A	100 GHz, 256 Gsa/s	4,2	1.0 mm
UXR0804A, UXR0802A	80 GHz, 256 Gsa/s	4,2	1.0 mm
UXR0704AP, UXR0702AP	70 GHz, 256 Gsa/s	4,2	1.0 mm
UXR0594AP, UXR0592AP	59 GHz, 256 Gsa/s	4,2	1.0 mm
UXR0404AP, UXR0402AP	40 GHz, 256 Gsa/s	4,2	1.0 mm
UXR0254AP, UXR0252AP	25 GHz, 256 Gsa/s	4,2	1.0 mm
UXR0051AP	5 GHz, 256 Gsa/s	1	1.0 mm
UXR0704A, UXR0702A	70 GHz, 256 Gsa/s	4,2	1.85 mm
UXR0594A, UXR0592A	59 GHz, 256 Gsa/s	4,2	1.85 mm
UXR0504A, UXR0502A	50 GHz, 256 Gsa/s	4,2	1.85 mm
UXR0404A, UXR0402A	40 GHz, 256 Gsa/s	4,2	1.85 mm

Table 1   Infiniium UXR real-time oscilloscopes (continued)

Model	Bandwidth, Sample rate	# of channels	Input connector type
UXR0334A	33 GHz, 128 Gsa/s	4	3.5 mm
UXR0254A	25 GHz, 128 Gsa/s	4	3.5 mm
UXR0204A	20 GHz, 128 Gsa/s	4	3.5 mm
UXR0164A	16 GHz, 128 Gsa/s	4	3.5 mm
UXR0134A	13 GHz, 128 Gsa/s	4	3.5 mm
UXR0104A	10 GHz, 128 Gsa/s	4	3.5 mm

The Keysight Infiniium UXR oscilloscopes deliver many features, including:

·   Lowest noise and jitter measurement floor

·   The industry's highest ENOB at bandwidths up to 110 GHz

·   Full bandwidth and channel upgradability

·   High-definition 10-bit analog-to-digital converter (ADC)

For more information about Infiniium oscilloscopes, go to www.keysight.com/find/scope.

In This Guide

This guide provides the information you need to begin using the Infiniium UXR real-time oscilloscopes.

Chapter 1, "Setting Up the Oscilloscope," starting on page 11, includes unpacking steps, power and air flow requirements, and other setup information.

Chapter 2, "Using the Oscilloscope," starting on page 31, familiarizes you with the keys, knobs, user interface, and other features such as the online help to get you started using the oscilloscope.

Chapter 3, "Calibrating the Oscilloscope," starting on page 57, describes how to perform a complete calibration of your oscilloscope so it can be referenced back to NIST-characterized standards.

Chapter 4, "Troubleshooting," starting on page 63, describes what to do if your oscilloscope is not working properly.

Chapter 5, "Testing Performance," starting on page 67, provides procedures for verifying the vertical performance of your oscilloscope.

Chapter 6, "Reference Information," starting on page 107, includes safety information, oscilloscope specifications and characteristics, and instructions for cleaning your oscilloscope.

For More Information

- For detailed information on how the oscilloscope makes measurements and how to use the oscilloscope, see the Infiniium oscilloscope application's online Help. See "Accessing the Online Help" on page 54.

- For information on controlling the oscilloscope from a remote computer, see the *Keysight Infiniium Oscilloscopes Programmer's Guide* found in the Infiniium oscilloscope application's online help.

For technical assistance, contact your local Keysight Technologies representative at http://www.keysight.com/find/contactus.

Contents

6 Reference Information

1 Setting Up the Oscilloscope

This chapter shows how to set up and prepare your Infiniium oscilloscope for first-time use.

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Inspecting Package Contents

✔ Inspect the shipping container for damage.

Keep the shipping container and cushioning material after you have inspected the contents of the shipment for completeness and have checked the oscilloscope mechanically and electrically. You can reuse undamaged shipping materials if you need to return the oscilloscope in the future.

If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier and your Keysight Technologies Sales Office. Keep the shipping materials for the carrier's inspection. The Keysight Technologies Sales Office will arrange for repair or replacement at Keysight's option without waiting for claim settlement.

✔ Inspect the oscilloscope.

If there is mechanical damage or a defect, or if the oscilloscope does not operate properly or does not pass performance tests, notify your Keysight Technologies Sales Office.

✔ Verify that you received the following items in the oscilloscope packaging.

Models	Include
All	UXR real-time oscilloscope
	power cord
	keyboard
	optical mouse
	Tips for Preventing Damage to Oscilloscopes
	ESD kit: mat, wrist strap, ground cord
	ESD Warning stickers
	software/firmware addendum
	safety leaflet
	Finding Product Manuals
	calibration certificate
	torque wrench, 8 in-lbs, 5/16"

Models	Include
Models with 1.0 mm Inputs	1.0 mm (f)-(f) ruggedized connector savers (one for each channel)
	1.0 mm to 1.85 mm (f)-(f) ruggedized connector savers (one for each channel)
	wrench, dual-ended, fits 6 mm and 7 mm
	wrench, 8 mm open end
	torque wrench, 4 in-lbs, for standard 1.0 mm connectors
	double-ended torque wrench, 4 in-lbs, 10 in-lbs, for ruggedized 1.0 mm connectors
	3.5 mm connector saver
	adapter, 1.0 mm ruggedized (f) to 2.92 mm
Models with 1.85 mm Inputs	1.85 mm (f)-(f) connector savers (one for each channel)
	3.5 mm connector saver
	adapter, 2.92 mm
Models with 3.5 mm Inputs	3.5 mm connector savers, kit of 5
	connector saver collars, kit of 10
UXR0134A 13 GHz and UXR0104A 10 GHz models only	N5442A Precision BNC (Auto Probe I to AutoProbe II) adapter (quantity 2)

✔ Verify that you received any options and accessories you ordered and that none were damaged.

For a complete list of options and accessories available for the Infiniium UXR real-time oscilloscopes, see the *Infiniium UXR Real-Time Oscilloscopes Data Sheet* at www.keysight.com/find/UXR.

Positioning the Oscilloscope

WARNING	**The Infiniium UXR oscilloscope may be difficult for a single individual to transport. Use of a two-person lift is required to avoid possible injury.**

For Safe Operation

WARNING	**Operate the Infiniium UXR oscilloscope in its top-up, bottom-down position only. These oscilloscopes have been designed and safety-certified for operation in this position only.**

For Proper Airflow

Position the oscilloscope where it will have at least 8 inches (203 mm) of clearance for airflow from the rear wall. The side handles provide sufficient airflow clearance side to side.

The fans draw air in from the sides and bottom, and blow it out the back of the oscilloscope.

CAUTION	VENTILATION REQUIREMENTS: When installing the oscilloscope into a cabinet, air temperature inside the cabinet must meet the oscilloscope's specified operating temperature range. Consider the convection flow into and out of the cabinet, and make sure to avoid having the heated discharge of one instrument become the cooling intake air for another instrument.

WARNING	**Because the oscilloscope's feet cover holes in the bottom of the chassis and provide proper airflow clearance, they must remain installed when operating the oscilloscope outside of an equipment rack.**
	The feet are removed from the oscilloscope when it is placed into a rack using the N2156A rack mount kit. When the oscilloscope is removed from a rack, the feet must be reinstalled for proper use on a flat surface.

Connecting Accessories and a LAN Cable to the Oscilloscope

1 Plug the mouse and keyboard into the USB host ports. Two USB host ports are on the front panel, with four more on the rear panel.

2 If you want to connect to a Local Area Network, connect your LAN cable to the RJ-45 LAN connector on the rear panel. Connect the other end to an open LAN port.
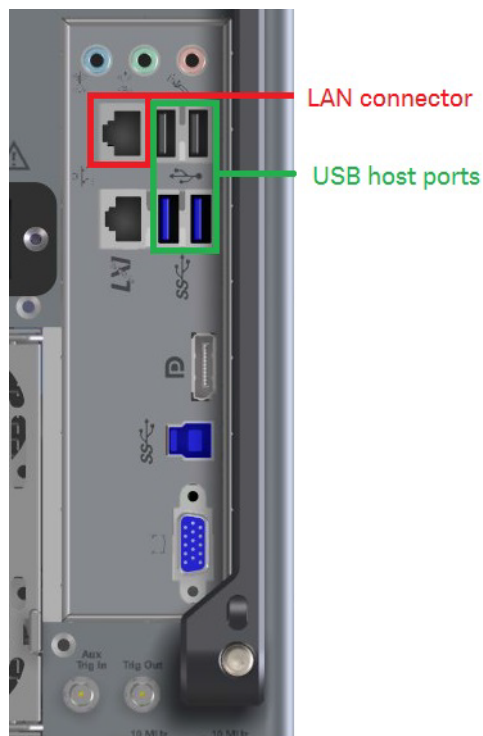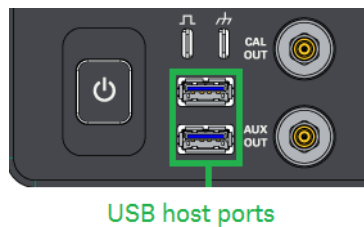
Figure 1   Connections for accessories and a LAN cable

Connecting Power to the Oscilloscope

Connect the supplied power cord to the rear of the oscilloscope, then to a suitable AC voltage source. Route the power cord so the oscilloscope's feet do not pinch the cord.
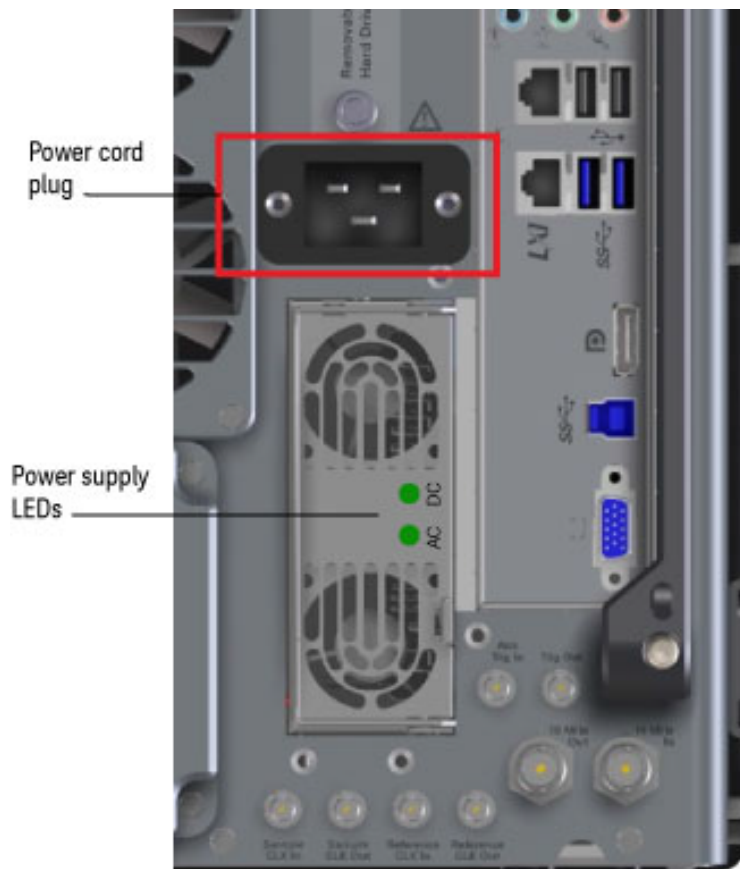
Figure 2   Connecting the power cord

The detachable power cord is the oscilloscope disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the oscilloscope. (The front panel switch is only a standby switch and is not a LINE switch.)

Make sure the detachable power cord is readily identifiable and is easily reached.

WARNING   **Do not use adapters, extension cords, or power strips.**

The use of these devices may lower the AC voltage below the required range and become a safety hazard.

WARNING   **The AC voltage source (outlet) must be in good repair and provide a secure electrical connection.**

Do not use the outlet if the power cord plug makes a loose connection with it, or if the power cord plug does not match the outlet. Do not use the outlet if it is damaged or if the outlet voltage is outside the required range.

CAUTION   Use the Supplied Power Cord.

Use only power cords designed for your oscilloscope. The power cord provided is matched to the country of origin of the order.

WARNING   **Properly Ground the Oscilloscope.**

To avoid electric shock, be sure the oscilloscope is properly grounded.

WARNING   **Failure to ensure proper earth grounding by not using the correct components may cause product damage and/or personal injury.**

CAUTION   This oscilloscope has auto-ranging line voltage input. Before switching on the oscilloscope, be sure the supply voltage is within the specified range and voltage fluctuations do not exceed ±10% of the nominal supply voltage.

Power Requirements

The power requirements for your UXR oscilloscope depend on the model, as shown in Table 2.

Table 2   Power requirements for Infiniium UXR Real-Time Oscilloscopes

UXR Model	Power Requirement
UXR1104A	Input: 200 to 240 VAC
UXR1004A	50/60 Hz
UXR0804A	Maximum input power: 2615 VA
UXR0704A/AP	Connect only to outlets rated for 15 amps or higher.
UXR0594A/AP	
UXR0504A	
UXR0404A/AP	
UXR0254AP	
UXR1102A	Input: 110 to 240 VAC
UXR1002A	50/60 Hz
UXR0802A	Maximum input power: 1370 VA
UXR0702A/AP	Connect only to outlets rated for 15 amps or higher.
UXR0592A/AP	
UXR0502A	For 110-120 V operation, connect only to a 20-amp
UXR0402A/AP	outlet or a dedicated 15-amp outlet.
UXR0252AP	
UXR0051AP	
UXR0334A	Input: 100 to 240 VAC
UXR0254A	50/60 Hz
UXR0204A	Maximum input power: 1350 VA
UXR0164A	
UXR0134A	
UXR0104A	

Well-regulated power is required for all Infiniium UXR real-time oscilloscopes.

Power Supply Protection Features

NOTE	The oscilloscope's power supply has a built-in thermal monitoring feature that keeps the fan running until the oscilloscope has cooled sufficiently. If the oscilloscope is turned off after it has been operating at the high end of its temperature range, the power/standby switch may flash green for several minutes before the oscilloscope can be turned back on.

The colors of the AC and DC LEDs on the power supply indicate the power supply conditions listed in Table 3.

Table 3   Power supply LED meanings

AC LED color	DC LED color	Condition
Green	Green	Normal operation
Off	Red	Low or NO AC
Green	Red	Power supply is off

When the front panel power/standby switch is blinking amber, a fault condition has occurred. You must unplug the power cord, wait 30 seconds, and then plug the power cord back in to reset the protection latch and allow the oscilloscope to be powered-on again.

Tilting the Oscilloscope for Easier Viewing

Tabs under the front feet of the oscilloscope can be flipped out to tilt the oscilloscope for easier viewing.
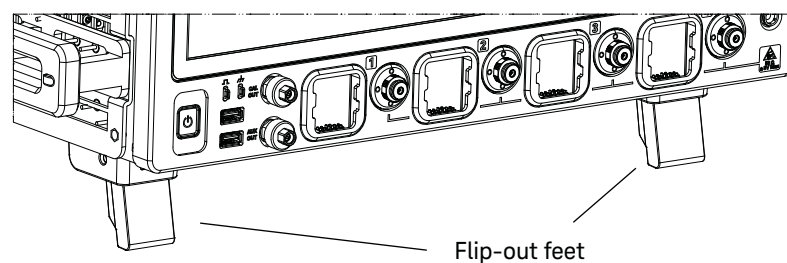
Flip-out feet

Figure 3   Flip-out tabs under front feet

Preventing Damage to the Oscilloscope Inputs

Avoid damaging the oscilloscope inputs by knowing the approximate signal level to be measured. Overpowering the front end can cause damage to the front end components. The maximum input signal level is 50 Ω ±2.0 V for UXR oscilloscopes with 1.0 or 1.85 mm connector types, and 50 Ω ±5.0 V for models with 3.5 mm connector types.

NOTE   Ruggedized connector savers are available for oscilloscope models with 1.0 mm connector types to protect the input connectors. Keysight recommends using them, as they provide a more secure connection without damaging the oscilloscope. For all other oscilloscopes, Keysight recommends using the provided connector savers.

CAUTION   When probes, adapters, or cables are connected to the UXR oscilloscope, the oscilloscope's channel input circuits can be damaged by ESD. Avoid applying static discharges to anything connected to the oscilloscope. Be sure the oscilloscope is properly earth-grounded to prevent buildup of static charge. Wear a wrist strap, which is provided with your oscilloscope.

CAUTION   Loose cables, much like loose capacitors, can hold electrostatic charges. The free end of a cable touching a charged surface can cause oscilloscope input damage. Before connecting any cable to an oscilloscope input, short the center and outer conductors of the cable together to ground momentarily. Alternatively, connect to a 50 Ω termination adapter to discharge the cables.

WARNING   **Use Only Grounded Instruments.**

Do not connect the ground lead of a probe to a potential other than earth ground. Always make sure the probe and the oscilloscope are grounded properly.

For more information on taking the best care of your oscilloscope, please read Tips for Preventing Damage to Oscilloscopes.

Applying Torque

| CAUTION | Over-tightening cables can damage the input connectors on the UXR oscilloscope. |

Proper signal connections are key to maintaining signal fidelity and preserving the full bandwidth of the oscilloscope. Each UXR oscilloscope comes with at least one torque wrench for tightening cable connections correctly.

Tightening connections on UXR models with 3.5 mm connector types

UXR oscilloscope models with 3.5 mm connector types have an automatic torque mechanism that ensures a consistent 8 in-lb connection.

Tightening connections on UXR models with 1.85 mm connector types

UXR oscilloscope models with 1.85 mm connector types come with a 5/16-inch torque wrench. Use it to tighten the connections to 8-in-lbs. The dual-ended 6 mm and 7 mm wrench is used to hold the mating connections in place while turning the connector.

Tightening connections on UXR models with 1.0 mm connector types

UXR oscilloscope models with 1.0 mm connector types come with a dual-ended torque wrench. One end is calibrated to 4 in-lbs for use when mating to standard 1.0 mm connectors; the other end is calibrated to 10 in-lbs for use only when mating to Keysight ruggedized 1.0 mm connectors.

1 Hold the handle at the double line as shown in Figure 4 to apply torque. If you hold the handle closer toward the head, you will apply more torque than what the wrench is set for. The wrench is a length-dependent tool.

2 Tighten the connector by applying a steady, even pull. The wrench should be kept at 90 degrees to the axis of the connector during tightening. When the preset torque is reached, the wrench will "break". Stop applying torque when the 45 degree break angle is achieved.

3 Reset the wrench for the next application.
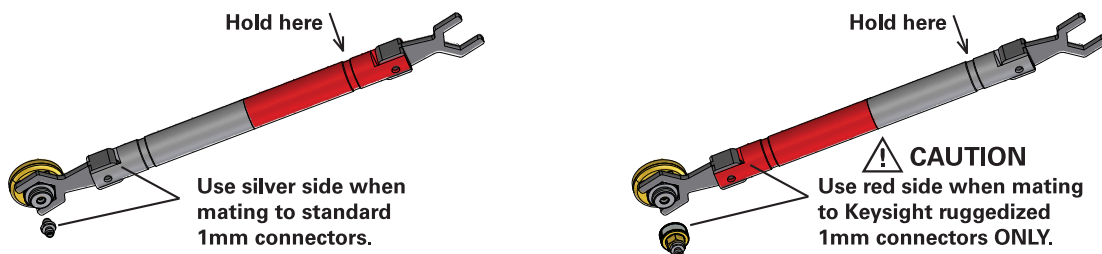
Figure 4   Applying torque

Preventing Damage to the 1.0 mm Adapters

These are *not* two adapters connected by a joint

1 piece

Not a connection (protect from torque)
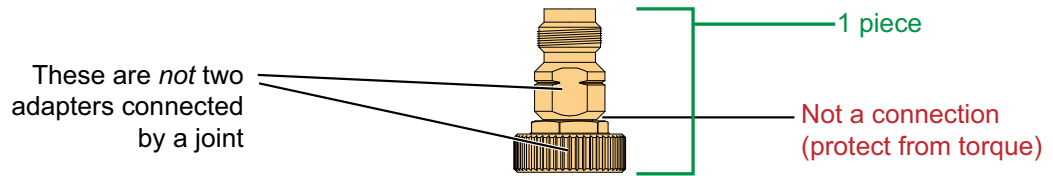
Figure 5   1.0 mm ruggedized adapters

Figure 5 shows two types of 1.0 mm ruggedized adapters:

- 1.0 mm to 1.85 mm adapter
- 1.0 mm to 2.92 mm adapter

These adapters are designed to be installed on the front-panel channel inputs. It is recommended that you always use a connector saver or adapter.

CAUTION	Due to the physical requirements needed to obtain high performance, the geometry of these, as well as all 1.0 mm connectors, demands special care to avoid expensive damage as explained in this section.

For the "to oscilloscope" and "to RF cable" connections, the following figures show the proper "flats" on which to place the wrenches.

Adapter to Channel Input (Step 1)

This figure show the correct placement of the 10 lb-in torque wrench (the red end) and the 8 mm open end wrench. On the adapter, connect the 8 mm wrench on the flats that are adjacent to the knurled ring.

Groove marks the correct place to hold wrench

8 mm open end wrench

10 lb-in torque wrench

Not a connection (protect from torque)

Do not place wrench here

Channel Input

1 mm to 1.85 mm (or 2.92 mm) adapter
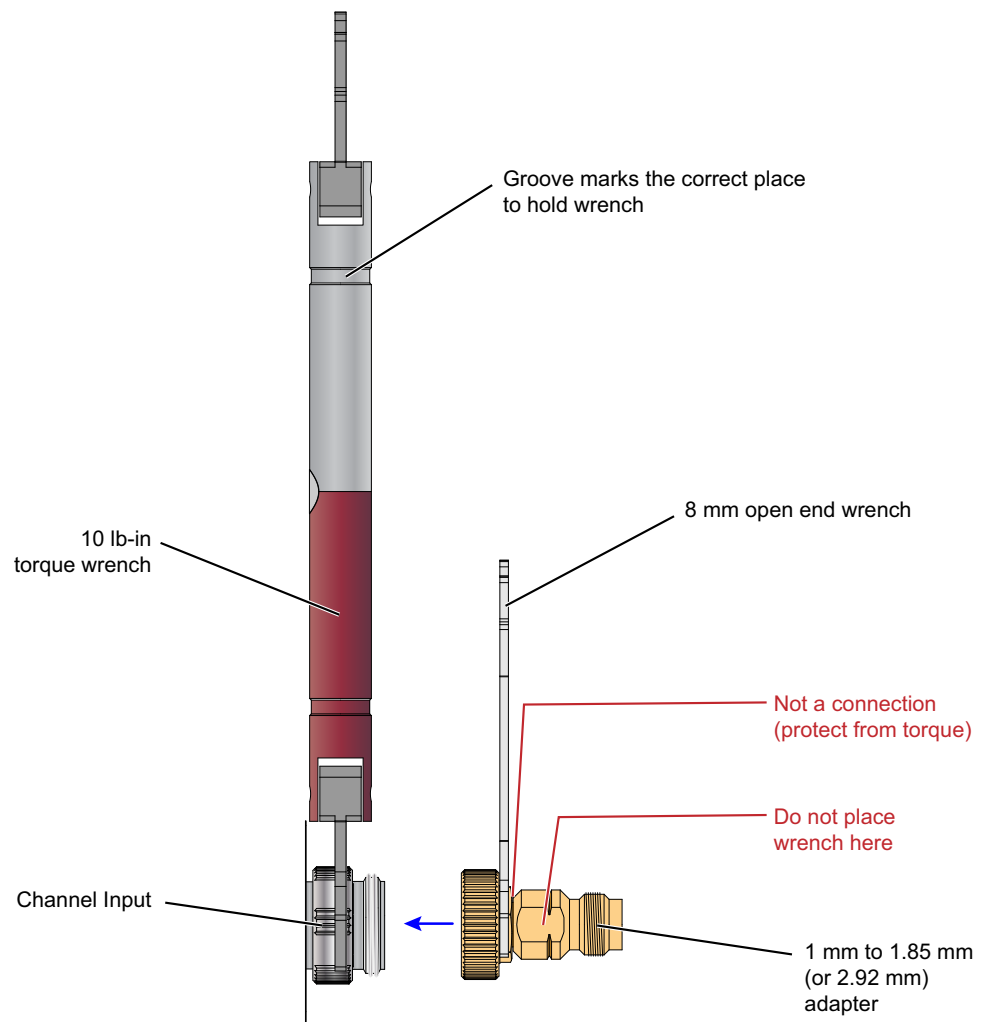
Figure 6   Wrenches positioned on correct flats when connecting 1.0 mm adapters to channel inputs

RF Cable to Adapter (Step 2)

This figure show the correct placement of the 8 lb-in torque wrench and the 7 mm open end wrench for connecting an RF cable, adapter, or other item to the 1.0 mm adapter.

Groove marks the correct
place to hold wrench

7 mm open-end
wrench

8 lb-in
torque wrench

1 mm to 1.85 mm
(or 2.92 mm)
adapter

cable

Channel Input

Not a connection (protect from torque)

Do not place wrench here
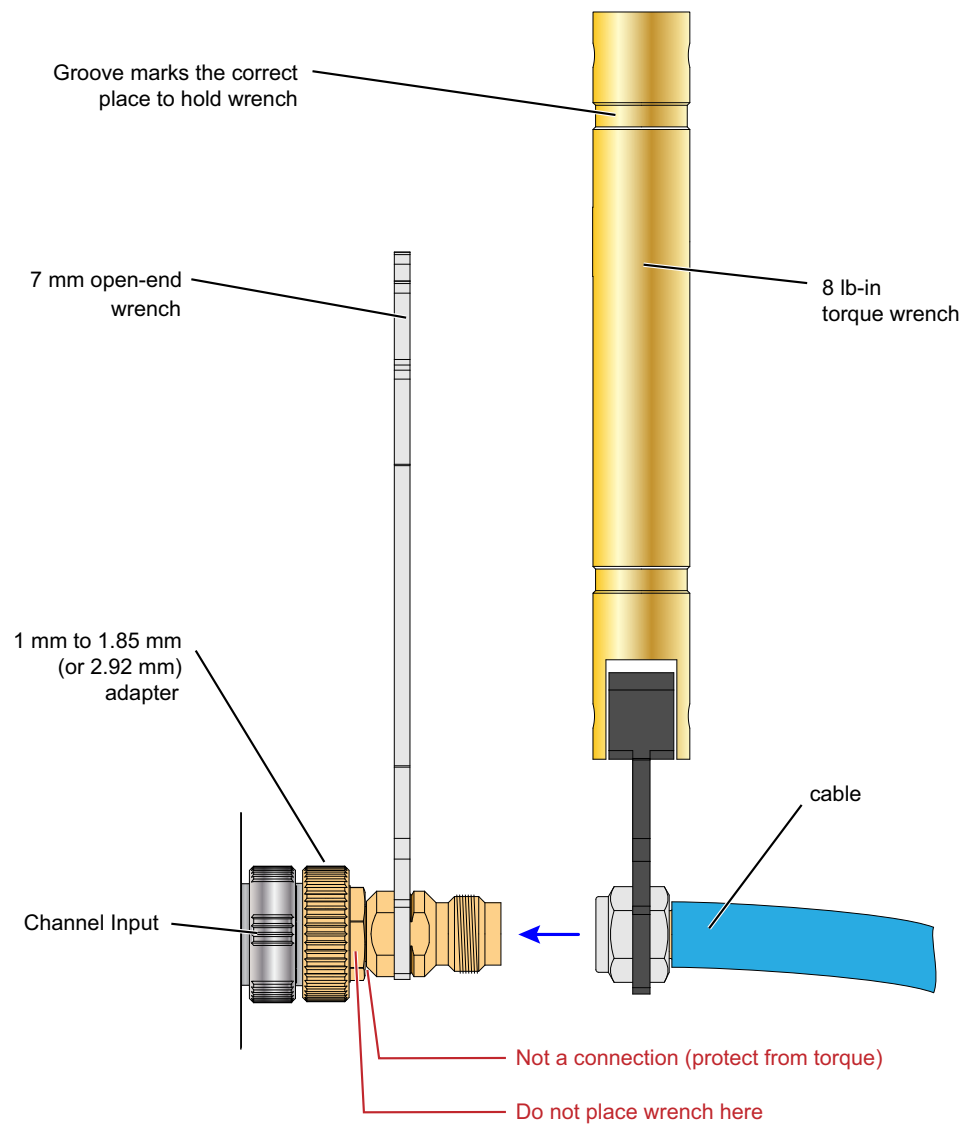
Figure 7   Wrenches positioned on correct flats when connecting RF cables to the 1.0 mm adapters

Turning On the Oscilloscope

To turn on the oscilloscope, press the power/standby switch ⏻ in the lower left corner of the front panel. The switch LED will blink green while the CPU starts up, and then become solid green. After this short initialization period, the oscilloscope display appears. The oscilloscope is ready to use.

You can connect and disconnect probes and cables while the oscilloscope is turned on.

Changing the Administrator Password

On Keysight Infiniium real-time oscilloscopes with the Windows 10 operating system, the default Administator user account password is "Keysight". Change the Administrator password to something more secure (and less well-known).

Verifying Basic Oscilloscope Operation

1 Connect one end of an SMA cable to oscilloscope channel input 1 using an adapter. Connect the other end to the Cal Out connector on the front panel using a connector saver, as shown in the following figures.

   Figure 8 shows the connections for an oscilloscope with 1 mm channel input connectors. A 1 mm ruggedized to 2.92 mm adapter is used to connect to channel 1, and a 3.5 mm connector saver is used to connect to the Cal Out connector.

Figure 8   Verifying basic oscilloscope operation -- models with 1.0 mm connector types

Figure 9 shows the connections for an oscilloscope with 1.85 mm channel input connectors. A 2.92 mm to 1.85 mm adapter is used to connect to channel 1, and a 3.5 mm connector saver is used to connect to the Cal Out connector.
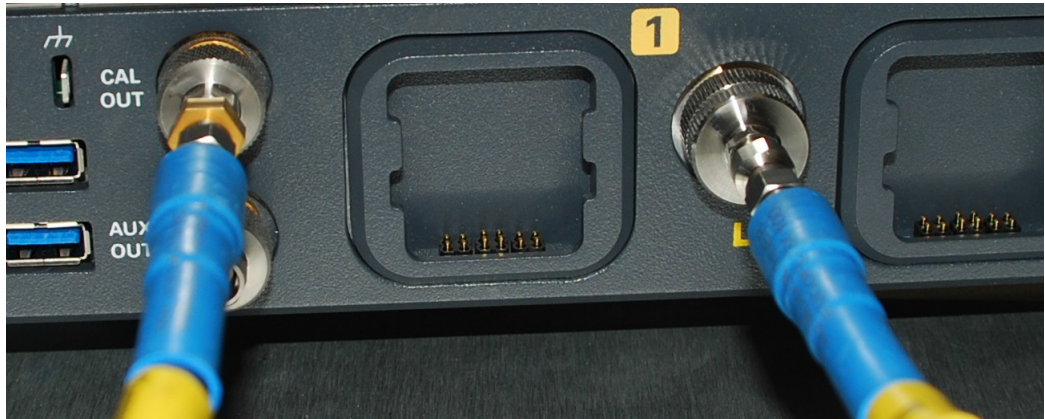
Figure 9   Verifying basic oscilloscope operation -- models with 1.85 mm connector types

Figure 10 shows the connections for an oscilloscope with 3.5 mm channel input connectors. A 2.4 mm to 2.92 mm adapter is used to connect to channel 1, and a 3.5 mm connector saver is used to connect to the Cal Out connector.

Figure 10   Verifying basic oscilloscope operation -- models with 3.5 mm input connectors

2   Press **[Default Setup]** on the front panel.

The display will pause momentarily while the oscilloscope is configured to its default settings. The oscilloscope is now in a known operating condition.

3   Press **[Auto Scale]** on the front panel.

The display will pause momentarily while the oscilloscope adjusts the time/div setting and vertical scale so the oscilloscope can best display the input signals. You should then see a square wave with about four cycles on screen and a peak-to-peak amplitude of approximately five divisions.

If you do not see the waveform, make sure your power source is adequate, the oscilloscope is properly powered on, and the cable is connected securely to the channel input and to the calibration output.

4   Move the mouse around the mouse surface and verify that the on-screen pointer follows the mouse movement.

5   Press the **[Touch]** key on the front panel to turn on the touch screen. Press and hold your finger to the screen. A right-click menu appears, which verifies that the touch screen is working properly.

Connecting Probes to the Oscilloscope

CAUTION	Ensure that the rated voltage of any probing accessory is not exceeded by the circuit to be measured.

CAUTION	Do not exceed the maximum input voltage rating. The maximum input voltage for the 50 Ω inputs is ±2 Vpeak for models with 1.0 and 1.85 mm connector types and ±5 Vpeak for models with 3.5 mm connector types.

The AutoProbe II and AutoProbe III interface connectors have pins that provide probe power, identification, and other communication signals. Infiniium UXR models with 3.5 mm connector types have an AutoProbe II interface, and Infiniium UXR models with 1.85 or 1.0 mm connector types have an AutoProbe III interface.

The AutoProbe II interface works with the InfiniiMax III probing system. For details, see the *Keysight InfiniiMax III/III+ Probing System Data Sheet.* Before using the InfiniiMax III probes, review the *InfiniiMax III Probe Handling Guide* included with the probes and available on the Keysight web site. These probes are ESD-sensitive devices and there is a proper order for connecting probe amplifiers to the oscilloscope, probe heads to the device under test (DUT), and probe heads to the amplifier.

Installing Application Programs on the Infiniium Oscilloscope

Infiniium has an open Windows operating system, which lets you install your own application software. Any application that runs on Microsoft Windows 10 and uses 16 GB of RAM or less may be installed on your Infiniium oscilloscope.

NOTE   Exit the Infiniium oscilloscope application before installing any software.

CAUTION   Installing an application that does not meet the preceding requirements may break the Infiniium oscilloscope application and require a hard drive recovery.

Changing Windows Operating System Settings

NOTE	Exit the Infiniium oscilloscope application before changing any Windows operating system settings outside of the Infiniium oscilloscope application.

Many Windows operating system settings can be changed to suit your own personal preferences. However, some operating system settings should not be changed because doing so would interfere with the proper operation of the oscilloscope.

· Do not change the Power Options.

· Do not change the Language settings.

· Do not remove Fonts.

· Do not change the screen resolution from 1024 by 768 pixels.

· Do not use Administrative Tools to enable or disable Internet Information Services (IIS) Manager. Use the Infiniium Remote Setup dialog box (**Utilities > Remote...**) to enable or disable the Web (HTTP) Server.

· Do not delete or modify the Infiniium Administrator user account.

Turning Off the Oscilloscope

To turn the oscilloscope off, press the power/standby switch ⏻ . The switch LED will remain solid green while the oscilloscope prepares to shut down and cool off, and then blink green until the shutdown is complete.

The front panel switch is only a standby switch and is not a LINE switch, which means that turning it off does not fully disconnect the oscilloscope from its power supply (AC mains).

2 Using the Oscilloscope

This chapter shows how to use the Infiniium UXR oscilloscope inputs and outputs, front panel controls, and user interface. It also includes procedures for calibrating your oscilloscope.

·   The familiar front-panel oscilloscope interface with knobs and keys is optimized for common tasks and basic measurements.

·   With the user interface for the Infiniium UXR oscilloscope you can access all of the oscilloscope's configuration and measurement features through an easy-to-use system of windows, menus, toolbars, dialog boxes, and buttons.

·   You have the option of using either the front panel controls or the user interface for many common tasks.

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Learning the Front Panel Connectors

Figure 11 and Figure 12 call out the front panel connectors on your oscilloscope.
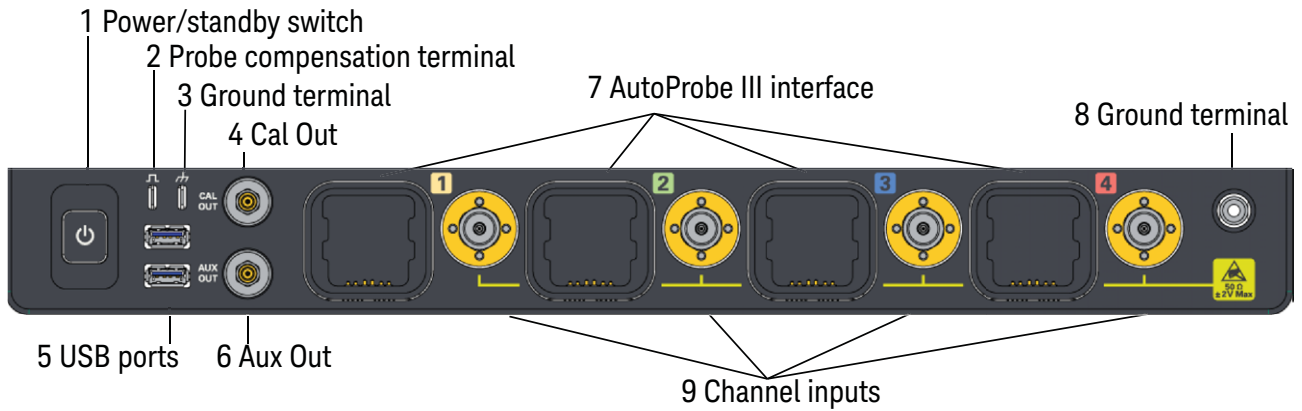
Figure 11   Front Panel Connectors for UXR models with 1.0 or 1.85 mm connector types
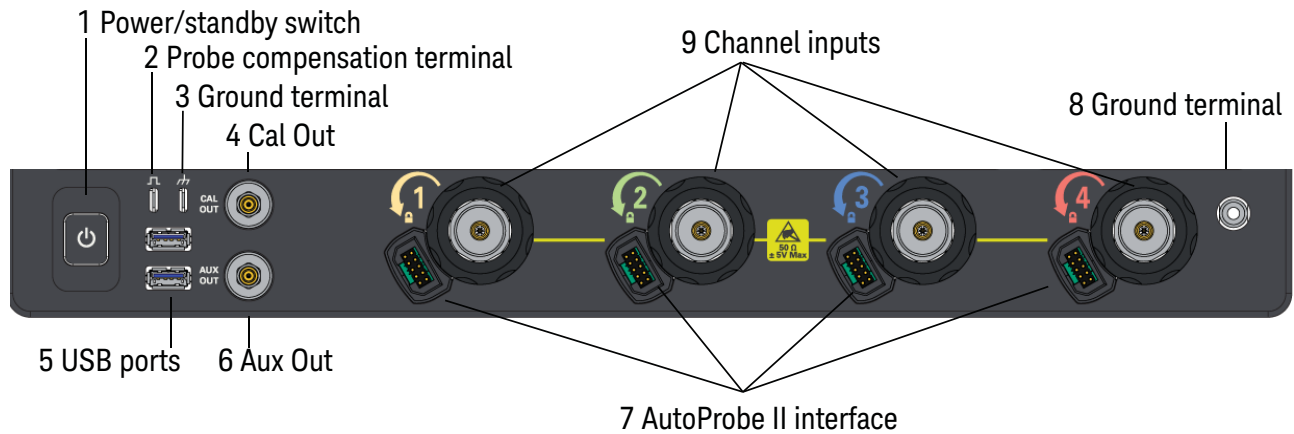
Figure 12   Front Panel Connectors for UXR models with 3.5 mm connector types

1.	Power/standby switch	Press once to switch power on; press again to switch power off. See "Turning On the Oscilloscope" on page 25.
2.	Probe compensation terminal ⎍	This terminal has a square wave signal that is used to adjust compensated passive probes. You can also output a DC level on this terminal using the Calibration Output dialog box (**Utilities > Calibration Output...**).
3.	Ground terminal	Connects to earth ground. **WARNING**: A voltage source should never be connected to the ground terminals of this oscilloscope. If the Protective Conductor Terminal on the power cord is disconnected or not functioning properly and a voltage source is connected to the oscilloscope's ground terminals, the entire oscilloscope will be at the voltage potential of the voltage source, and the user or bystanders could receive an electric shock.
4.	Cal Out	This output signal can be a demo signal.
5.	USB ports	The two USB 3.0 host ports can be used for connecting USB mass storage devices (such as flash drives), printers, or accessories to the oscilloscope. Additional USB ports are on the rear panel. You do not need to eject the USB mass storage device before removing it. Make sure that any file operation you initiated is done before removing the USB drive.
6.	Aux Out	This calibration output is used when performing a calibration on the oscilloscope. The output signal is selected by the Calibration Output dialog box (**Utilities > Calibration Output...**). It can be an AC signal, the probe compensation signal, the trigger out signal, or a demo signal.
7	AutoProbe connectors	The calibration module and probe connectors connect to the AutoProbe II or III interface, depending on oscilloscope model.
8	Ground terminal	The ground terminal is convenient for wrist straps. **WARNING**: A voltage source should never be connected to the ground terminals of this oscilloscope. If the Protective Conductor Terminal on the power cord is disconnected or not functioning properly and a voltage source is connected to the oscilloscope's ground terminals, the entire oscilloscope will be at the voltage potential of the voltage source, and the user or bystanders could receive an electric shock.
9	Channel inputs	UXR oscilloscopes ≥80 GHz and the 59 GHz AP models have ruggedized 1.0 mm input connectors, and oscilloscopes 40 to 70 GHz (except the 59 GHz AP models) have 1.85 mm input connectors. Both of those inputs are 50 Ω ±2V Max. UXR oscilloscopes ≤ 33 GHz have 3.5 mm input connectors; the inputs are 50 Ω ±5V Max.

Learning the Rear Panel Connectors

1 Audio connectors

2 LAN connector

3 USB host ports

4 USB III host ports

5 Power cord connector

6 Display port

7 USB III device port

8 External monitor connector

9 Aux Trig In, Trig Out connectors

10 10 MHz Out, 10 MHz In clock synchronization connectors

12 Sample CLK In, Sample CLK Out connectors

11 400 MHz Reference CLK In, 400 MHz Reference CLK Out connectors
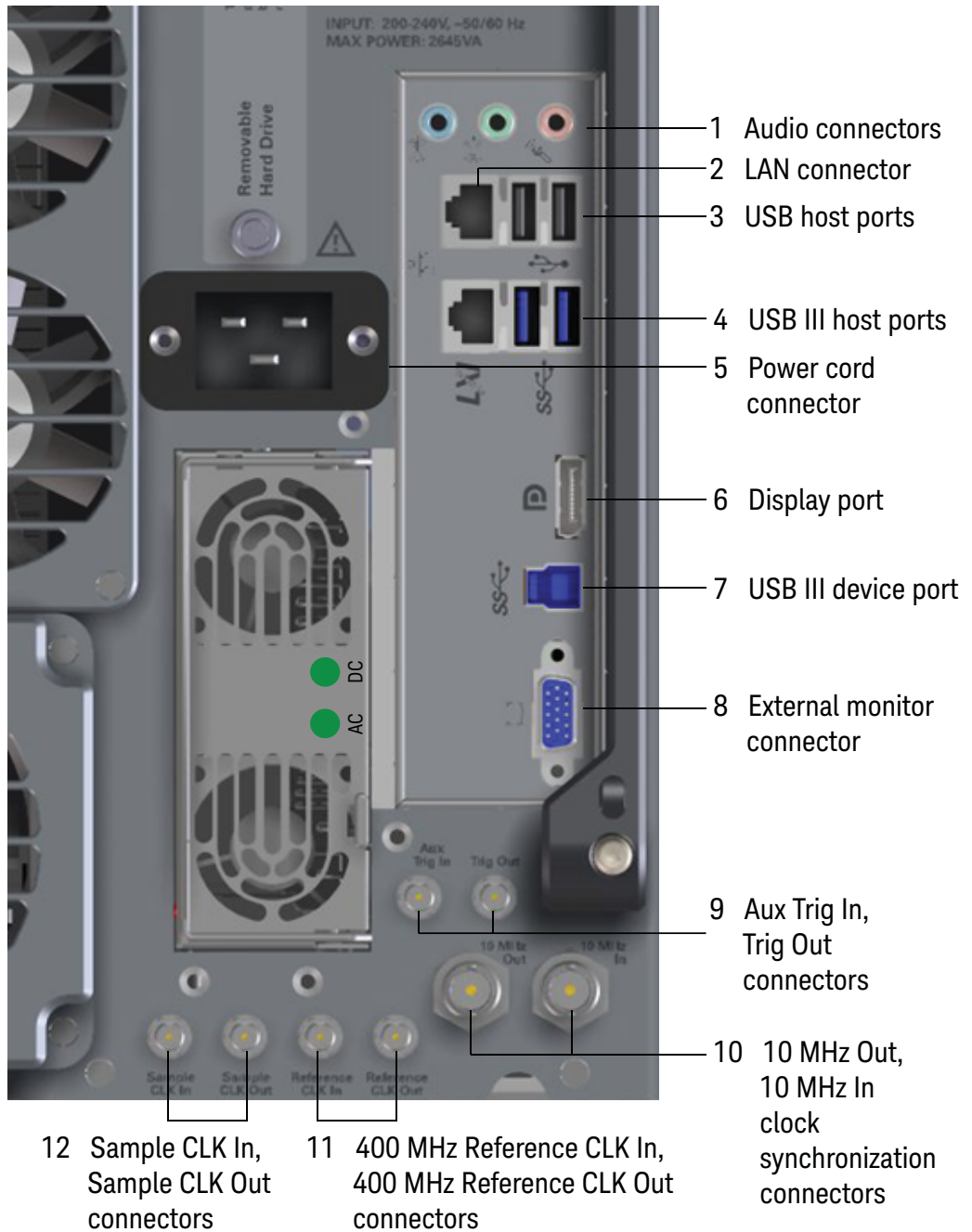
The ⚠ symbol above the power cord connector is a caution to use the power cord that came with the oscilloscope.

1	Audio connectors	The audio connectors, left to right, are line-in, front speaker out, and microphone input.
2	LAN connector	This connector is compatible with 10/100/1000Base T protocols.
3, 4	USB host ports	These ports are for connecting USB mass storage devices or printers to the oscilloscope. CAUTION: Do not connect a host computer to the oscilloscope's USB host port. A host computer sees the oscilloscope as a device, so connect the host computer to the oscilloscope's device port.
5	Power cord connector	Attach the supplied power cord here.
6	Display port	This display port is for driving an external monitor.
7	USB III device port	This port is for connecting the oscilloscope to a host PC. You can then issue remote commands from a host PC to the oscilloscope.
8	External monitor connector	This VGA connector is for a legacy external monitor.
9	Aux Trig In	You can set up the oscilloscope to trigger on the auxiliary trigger signal connected to the Aux Trig In SMA input.
	Trig Out	Pulses corresponding to oscilloscope triggers can be sent to the Trig Out SMA output.
10	10 MHz In	The 10 MHz In BNC connector is used to phase lock the oscilloscope to an external timebase reference clock. This input can also be used to provide a lower phase noise reference than the internal reference so that the oscilloscope's jitter measurement floor is lowered on long (≥10 ms) acquisitions. If the external timebase reference clock frequency and amplitude do not meet certain requirements (see "Input and Output Ratings" on page 36), the internal reference will be used and a message will appear.
		To use the external timebase reference clock, connect it to the 10 MHz In BNC connector. Then, in the Infiniium oscilloscope application's Horizontal dialog box (**Setup > Horizontal...**), enable the 10 MHz External Reference Clock.
	10 MHz Out	You can use the 10 MHz Out BNC connector to send the oscilloscope's 10 MHz reference clock output signal to another instrument's reference clock input.
11	400 MHz Reference CLK In, 400 MHz Reference CLK Out	These connectors are used for MultiScope applications and should remain disconnected during single-scope applications.
12	Sample CLK In, Sample CLK Out	These connectors are used for MultiScope applications and should remain disconnected during single-scope applications.
		A 50 Ω termination has been included on the Sample CLK Out connector. Do not operate the instrument with this output unterminated. Operating the instrument with this output unterminated will damage the instrument and void the warranty.

Input and Output Ratings

The ratings for each input and output are shown below:

Probe compensation terminal ⎍	0 V to 5 V, 50 Ω impedance
Cal Out	-2.4 V to +2.4 V, 50 Ω impedance
Aux Out	0 V to 5 V, 50 Ω impedance
Channel inputs	50 Ω impedance, ±2 V Max (models with 1.0 or 1.85 mm connector types)
	50 Ω impedance, ±5 V Max (models with 3.5 mm connector types)
Aux Trig In	50 Ω impedance, 5 Vpp max signal between -5 V and +5 V
Trig Out	0 V to 5 V, 50 Ω impedance
10 MHz In	**Input frequency lock range:** 10 MHz ±20 ppm
	Amplitude, sine wave input: 630 mVpp (0 dBm) min to 3.54 Vpp (+15 dBm) max
	Amplitude, square wave input: 500 mVpp min to 2.83 Vpp max
	Input impedance: 50 Ω (typical)
	Notes:
	▪ The oscilloscope will lock to input amplitudes ranging from -5 dBm to +15 dBm (sine wave); however, the best intrinsic jitter performance is achieved between 0 dBm and +15 dBm.
	▪ For inputs at or slightly below -5 dBm, the oscillator assembly will disconnect from the external reference input, the oscilloscope application will automatically connect to the internal reference signal, and a message will appear indicating the external reference signal amplitude is too low and the oscilloscope is now using the internal reference. To continue using the external reference, you need to increase the input amplitude above -5 dBm so the hardware will remain connected to the external reference signal.
	▪ For inputs at or slightly above +15 dBm, the oscillator assembly will disconnect from the external reference input, the oscilloscope application will automatically connect to the internal reference signal, and a message will appear indicating the external reference signal amplitude is too high and the oscilloscope is now using the internal reference. To continue using the external reference, you need to reduce the input amplitude to +15 dBm or less so the hardware will remain connected to the external reference signal.
10 MHz Out	**Amplitude into 50 Ω (internal or external timebase reference selected):** 1.1 Vpp to 2.0 Vpp (+5 dBm to +10 dBm) sine wave
	Frequency accuracy, internal timebase reference selected: 10 MHz ±(initial 25 ppb + aging)
	Aging factors:
	▪ First year: 100 ppb
	▪ Each year after first: 30 ppb/year
	Frequency accuracy, external timebase reference selected: external reference frequency (input to 10 MHz In)

Reference CLK Out	400 MHz, 0.25 Vpp to 0.40 Vpp
Reference CLK In	400 MHz, 0.25 Vpp to 0.50 Vpp
Sample CLK Out	8 GHz, +10 dBm to +15 dBm
Sample CLK In	8 GHz, -5 dBm to +15 dBm

Learning the Oscilloscope Display

The user interface is arranged so the most common functions affecting the waveform display are located around the edge of the waveform display area.

Context-sensitive menus are available by right-clicking something in the waveform display area, such as the grid, a signal, a bookmark, or a measurement. You can mouse over or touch other areas, such as the drag & drop measurements area and horizontal and acquisition control regions, to see tooltip information about those areas or to enter data.
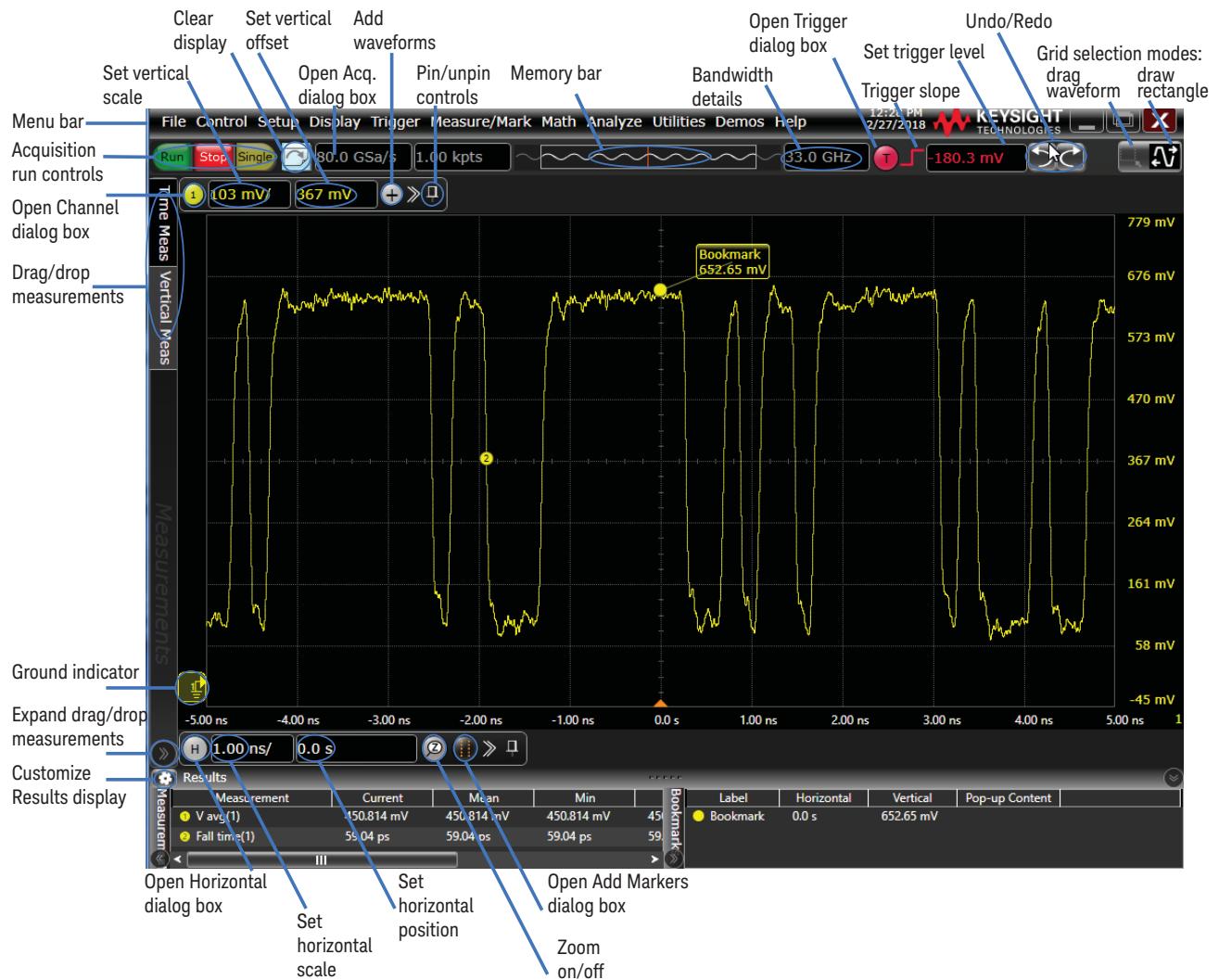
Figure 13   Infiniium display

Table 4   Infiniium display areas

Menu bar	Use menu selections to perform defined operations and access every function the oscilloscope provides.
Grid selection modes	The selected grid mode determines whether you manipulate waveforms or draw a selection box when you touch the screen.
Waveform display area	The waveform display area shows up to eight waveform windows. Several display options are available, such as grids or horizontal and vertical scales.
Results pane	A Results pane is visible at the bottom of the display when you do something that produces results, such as taking a measurement or using bookmarks. When it is not needed, the Results pane is not visible.

Learning the Front Panel Controls (Keys and Knobs)

The Infiniium UXR oscilloscope front panel controls provide direct access to the functions needed to perform the most common measurements. Knobs and keys let you directly set vertical and horizontal parameters. You can see the oscilloscope's configuration at a glance.

The oscilloscope uses color consistently throughout the front panel and user interface. For example, the color of the knob for channel 1 is the same color as the waveform for channel 1. All configuration items and values related to channel 1 are displayed in the same color.
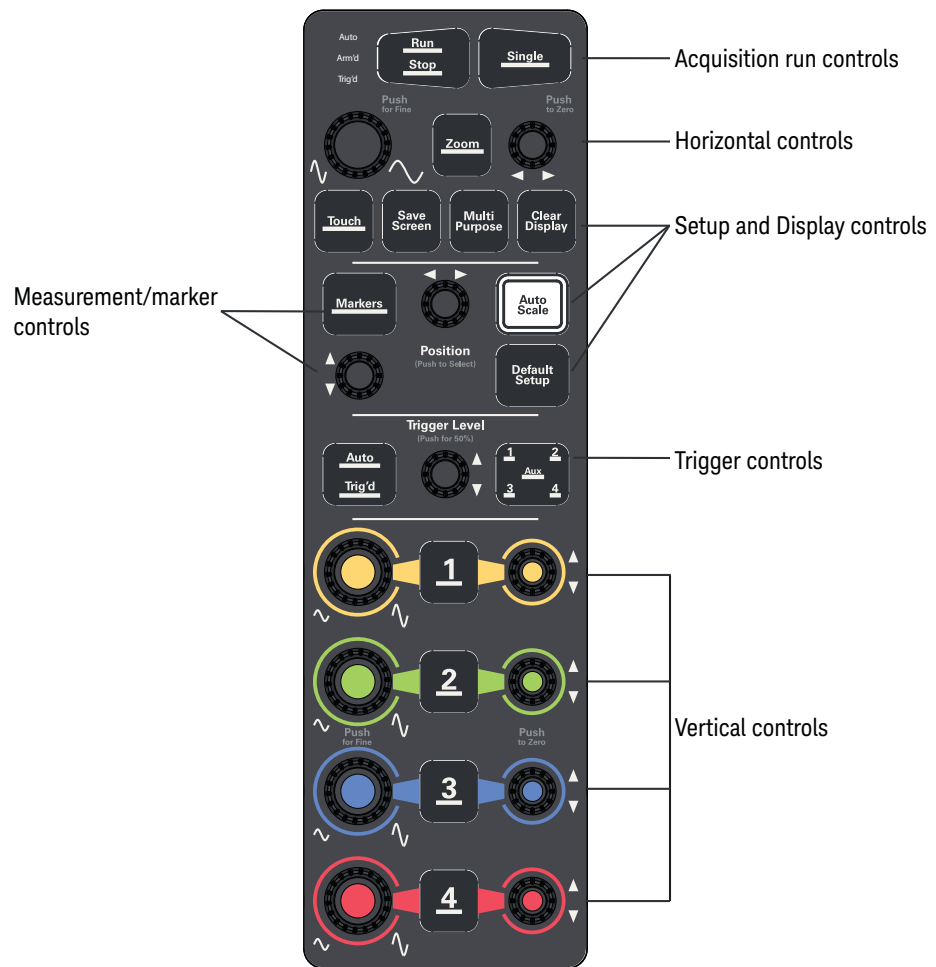
Figure 14   Front panel controls

Using the Setup and Display Controls

With the setup and display controls you can enable or disable the touch screen, save the screen image, define a key to perform automatic measurements or other quick actions, clear the display, quickly get a stable waveform display, and set the oscilloscope to a known starting condition.
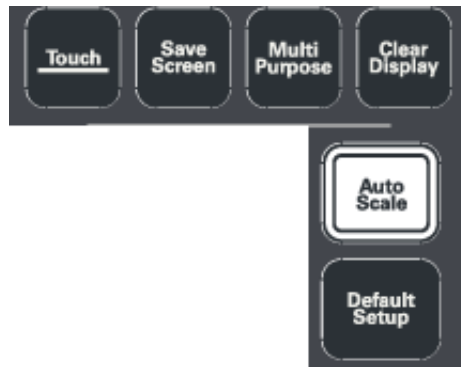
Figure 15   Setup and display control keys

Using Auto Scale and Default Setup

To automatically configure the oscilloscope to best display the current input signal(s), press **[Auto Scale]** or choose **Control > Autoscale**. The oscilloscope will determine which channels have activity, and will turn these channels on and scale them.

To reset the oscilloscope to its default setup, press **[Default Setup]**. You can use the **Undo** button ⤺ to undo a default setup.

> **NOTE**   Save the Current Oscilloscope Configuration
>
> Before using the default setup, you may want to save the current oscilloscope configuration for later use. See the online help (described later in this chapter) for instructions on saving setups, and for information on the exact configuration that is set when you use the default setup.

Using the Touch Screen

1   To enable the touch screen so it responds to multi-touch gestures, similar to those used on tablets and smart phones, press **[Touch]** or choose **Utilities > User Preferences...** and select the **Enable Touch Screen** check box.

2   Touch the drag waveform icon ⏶⏷ to highlight it.

Now you can use gestures to flick items horizontally, drag a waveform vertically, drag horizontally to change the horizontal delay, pinch horizontally to adjust time/div and delay settings, pinch vertically to adjust a waveform's V/div and offset settings, or tap to select waveforms and other selections on the display.

Saving the Screen Image

To save the screen image to a file for use in other programs or documents, press **[Save Screen]** or choose **File > Save > Screen Image...**.

The first time you save a screen image you will be prompted to enter a location for the saved file. Subsequent saves automatically place the file in that location.

Using Quick Measurements

You can define the **[Multi Purpose]** key to perform one of many quick actions, such as loading a setup file, saving composite data or a measurement report to a file, saving the screen image to a bitmap file, or performing automatic measurements.

The action taken when **[Multi Purpose]** is pressed (or **Utilities > Multipurpose** is chosen) depends on the feature selected in the Customize Multipurpose dialog box (**Utilities > Customize Multipurpose...**). The default feature is QuickMeas.

- To turn on the quick measurement display, press **[Multi Purpose]**. The 10 preset measurements defined in the Quick Measurement configuration are enabled and results appear on the screen for the first waveform source.

- To measure parameters for another waveform, press **[Multi Purpose]** until that waveform is the one shown in the measurement readout. Continuing to press **[Multi Purpose]** cycles through each of the waveforms available.

- To turn off the quick measurement display, cycle through all channels until the measurements are turned off.

See the Infiniium oscilloscope application's online help for information on how to configure the quick measurement capability.

Clearing the Waveform Display

When you press **[Clear Display]** or click the button, the oscilloscope clears acquired waveform data from the display in preparation for another acquisition. If the oscilloscope is in Run mode and is receiving triggers, it will update the display as it collects new waveform data.

Clearing the waveform display also resets averaging, infinite persistence, color grade persistence, histograms, measurement statistics, and the mask testing database.

Starting and Stopping Waveform Acquisitions

Use the acquisition run controls to run and stop acquisitions or make a single acquisition. The boxed area of the memory bar shows which portion of the channel's acquisition memory you are viewing.

Figure 16   Acquisition run control keys and buttons

- To start waveform acquisition, press **[Run/Stop]** or click **Run**.

  The oscilloscope begins acquiring data. When it receives a trigger signal, it finishes acquiring data, updates the display, and then starts another acquisition cycle if it is in Trig'd or Auto trigger mode.

- To stop waveform acquisition, press **[Run/Stop]** or click **Stop**. Data that was last acquired remains on the screen.

- To make a single acquisition, press **[Single]** or click **Single**.

- You can also choose the Run, Stop, and Single commands from the Control menu.

- To set up how you want the signals to be sampled, such as sampling rate and mode, choose **Setup > Acquisition...**.

Adjusting the Horizontal Settings

Use the horizontal controls to configure the horizontal scale and horizontal position of the waveform. You can view a magnified section of the waveform using the zoom window.

Use gestures on the touch screen to adjust the horizontal scale and position. You can also use the horizontal knobs, horizontal controls, or Horizontal dialog box.

Adjusting the Horizontal Scale
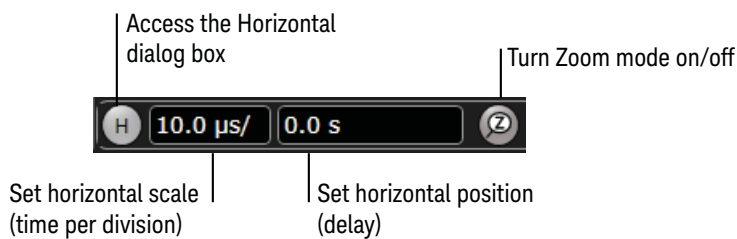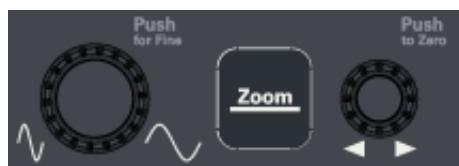
Figure 17   Horizontal controls

- The horizontal scale knob is the larger of the two horizontal control knobs. To stretch the waveform horizontally (displaying fewer seconds per division), turn the knob clockwise. To shrink it horizontally, turn the knob counter-clockwise.
- Push the horizontal scale knob to change the scaling in finer (Vernier) increments.
- You can also use multi-touch gestures to stretch or shrink the waveform.
- To adjust the horizontal scale using the controls in the horizontal toolbar, mouse over or touch the horizontal scale field and use the resulting controls to set a particular horizontal scale. Click the scale field to enter an exact value, or click the "narrower" or "wider" buttons.

Adjusting the Horizontal Trigger Position (Delay)

- The horizontal position knob is the smaller of the two horizontal control knobs. Turn it to move the waveform to the right or left.

Moving the waveform to the right shows more of the pre-trigger data (data acquired before the trigger event). Moving it to the left shows more post-trigger data.

- When you drag a waveform, the horizontal position will change for all channels and functions on the display. Waveform memories will also move if you select the **Tie To Timebase** check box in the Waveform Memories dialog box.

- To use the controls in the horizontal toolbar to adjust the horizontal position, mouse over or touch the horizontal position field and use the resulting controls to set a particular horizontal position (time relative to the trigger at the highlighted horizontal reference point).

Magnifying a Part of the Waveform Using Zoom

- To turn on zoom, press the **[Zoom]** key or click the Zoom button ⓩ.

  The waveform display area splits into two regions. The top one is the main timebase. The bottom is the zoomed timebase, which represents an expansion of the acquired waveform data. A section of the waveform in the main timebase window is highlighted to indicate the part shown in the zoomed timebase window.

  The horizontal scale and position controls now change how the waveform is shown in the zoomed timebase window. The horizontal scale will change the amount of magnification, while the position will change the part of the waveform in the main window that is shown in the zoomed window.

- To turn off zoom, press **[Zoom]** or click ⓩ again.

NOTE	When zooming on a waveform while the oscilloscope is making acquisitions, be careful to keep the signal within the screen vertically to avoid overdriving the vertical input amplifiers. Overdriving causes waveform distortion and erroneous measurement results.

Setting the Scale, Position, and Timebase Reference Point

To set scale, position, and timebase reference, use the Horizontal dialog box or set up the zoomed timebase window.

- To access the Horizontal dialog box, click the Ⓗ in the horizontal toolbar, or choose **Setup > Horizontal...** from the main menu.

- The Timebase Reference ranges from 0 to 100% of the screen. The center of the screen is at 50%. The slider correlates to the hollow orange triangle at the bottom of the display area, showing where the horizontal offset is on the screen.

Adjusting the Vertical Settings

Use the vertical controls to set the vertical scaling and vertical offset for each analog channel, and to turn the display on or off for a specific channel.
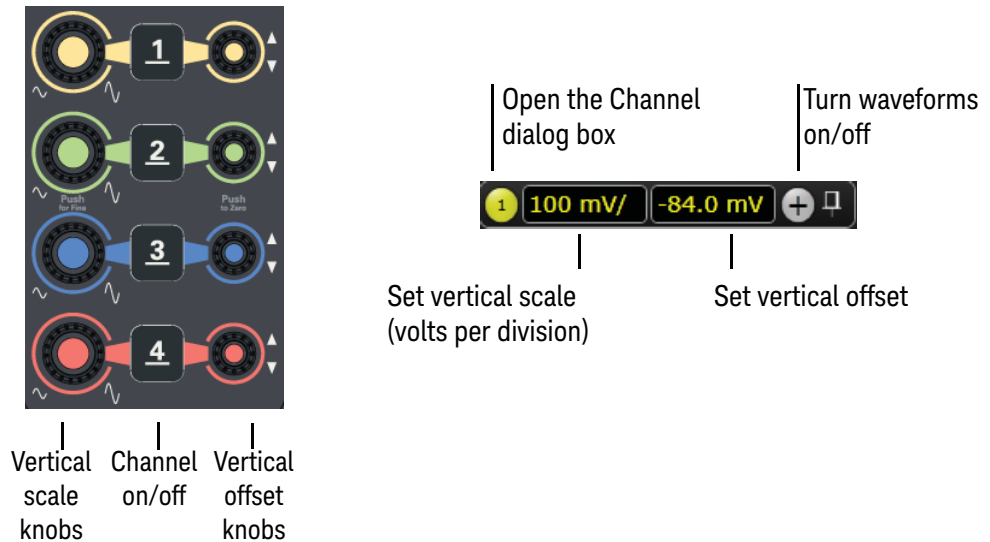
Figure 18   Channel and vertical controls

Turning a Channel On or Off

To turn a channel on or off, press the channel number key on the front panel or click the Add Waveforms button ⊕. When you turn off a channel, the current vertical scale and offset fields for that channel disappear.

If you are not using a particular channel, you can turn it off to simplify the waveform display and increase the display update rate. Functions continue to run on a channel source that is turned off. Data acquisition continues for a channel if a function requires it.

> **NOTE**
>
> Using a Channel as Trigger
>
> Any channel can be used as a trigger source. If you need a trigger but do not need all channels, you can use a channel as a trigger without displaying it by turning the channel display off.

Adjusting the channel's vertical settings

To adjust the vertical scale and offset, use the vertical scale and offset knobs, vertical user interface controls, or Channel dialog box.

The vertical scale knob is the larger of the two knobs for a channel. Turn it to make the waveform bigger (fewer volts per division) or smaller. You can also mouse over or touch the vertical scale field and use the resulting controls to set an exact value for the scaling.

The vertical offset knob is the smaller knob for a channel. Turn it to move the waveform up or down.

You can drag the waveform or its ground reference indicator to the desired vertical offset if the grid is in drag mode .

Choose **Setup > Channel N...** or click a channel number to open the Channel dialog box, in which you can set the vertical scale, offset, skew, and labels.

Setting Up Triggers

Use the trigger controls to set the conditions on which the oscilloscope will trigger and acquire an input signal. You can set up a variety of trigger conditions. Edge triggers and the parameters for edge triggering can be set up from the front panel.

Trigger configuration settings you make using the user interface are reflected in the front-panel Trigger Level status indicators, and will remain set unless you change them or press **[Default Setup]**.

Figure 19   Trigger controls and indicators

To set the oscilloscope to trigger on an edge:

1   Press **[Aux]** until the desired trigger source LED is illuminated.

You can choose any channel or the **Aux** input as the source for an edge trigger.

2   Press **[Auto]** or **[Trig'd]**.

When **Auto** is selected, an acquisition is automatically saved and displayed if a trigger does not occur within a certain amount of time. In Auto trigger mode, you are able to see your signals while setting up the desired trigger.

When **Trig'd** is selected, the oscilloscope must find the trigger before saving and displaying captured data.

3   Turn the Trigger Level knob to adjust the voltage level at which the oscilloscope will trigger. Push the knob to set the trigger to the middle of the waveform.

Use the Trigger dialog box to select any of the different modes of triggering, the parameters and conditions for each trigger mode, and advanced configuration items.

You can also mouse over the trigger level field and use the resulting controls to set a particular trigger level when the oscilloscope is set for edge triggering on a particular channel. Likewise, you can drag the trigger reference indicator at the left side of the display, or drag the trigger line itself, which appears when you click or touch the grid.

Making a Measurement and Using Markers

Use the measurement/markers controls to display and adjust markers and make measurements.

Figure 20   Front panel measure controls and Markers button
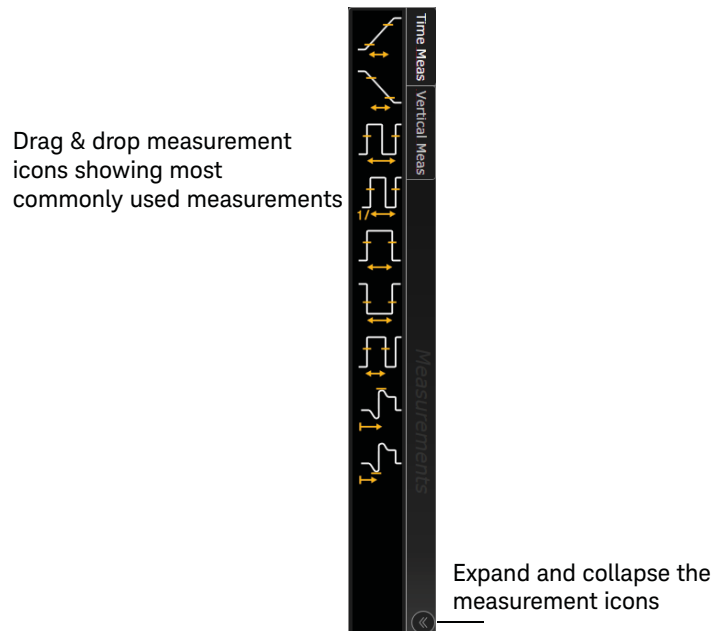
Figure 21   Drag & Drop measurements

Making a Measurement on a Waveform

To make a measurement, either drag a measurement icon to the waveform event you want to measure, or click a measurement icon and use the resulting dialog box to specify which source you want to measure.

For measurements on waveform features, such as those that involve waveform edges, if you click a measurement icon and specify a source, the measurement defaults to using the feature closest to the horizontal reference point. If you make the measurement using drag & drop, the measurement uses the waveform feature closest to the point where you drop the icon.

The most commonly used measurements are available in the drag & drop area. Others are available from the Add Measurement dialog box (**Measure/Mark > Add Measurement...**).

When you drag and drop a measurement icon on a waveform, the icon outline changes color to match the color of each waveform it touches so you can easily see which waveform will be measured.

For edge-sensitive measurements, a circled number appears in the waveform marker color when you drop the measurement icon on a waveform. This number shows exactly where the measurement is being made. It appears next to the measurement readout in the Results pane. This feature helps you distinguish measurement results from each other when you make multiple measurements on the same waveform but at different waveform features.
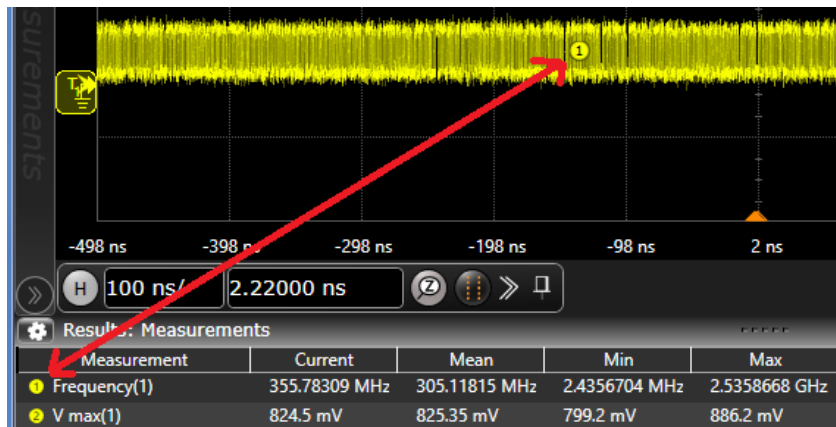
Using Markers

Markers make it easier to make precise measurements because the marker measurement readouts show exact voltage and time positions for the markers. The measurements are based on actual waveform data from the acquisition system, not on approximations based on the display position, so you can be sure the values are highly accurate.

Using the marker and measurement controls, you can control multiple sets of markers within the oscilloscope grid.

Both time and voltage differences between the markers are updated continuously on the screen. By default, the markers track the source waveform. Voltage measurements from the markers are the value of the waveform at the time set with the marker arrow keys.

- To add markers, press the **[Markers]** key or click the Markers button , then select the sources and mode. Notice the drawing in the **Description** area of the dialog box.

- To move a marker, click and drag it or turn the horizontal or vertical Position knob. Push the knob to select the next marker.

- You can use the front panel Position knobs for fine adjustment, or use the Add Marker dialog box to set the marker position precisely.

Saving and Printing Data

- Choose **File > Save >** to save your composite, setup, waveform, screen image, or measurement data. You can also save to a waveform memory.
- Choose **File > Copy Screen Image** to easily copy and paste a screen image into a document.
- Choose **File > Print...** to send waveform and setup data to a specified printer.
- You can customize the **[Multi Purpose]** key to perform certain actions such as a QuickPrint very quickly.

Forcing a Default Setup

If your Infiniium oscilloscope is not working properly when you start it up, follow these steps to perform a default setup and return the Infiniium oscilloscope to normal operation.

1 Press **[Default Setup]**.

2 If the oscilloscope is still not working properly, choose **Setup > Factory Default** to return the oscilloscope to the default settings it had when it left the factory.

3 If the oscilloscope is still not working properly, turn it off.

4 After the blinking green power/standby LED turns off, turn the oscilloscope back on. If it does not successfully restart, try recycling the power again.

5 As soon as the Windows load screen disappears, press **[Default Setup]**. If the oscilloscope still does not successfully restart, follow the instructions below for recovering the hard drive.

Recovering the Infiniium Hard Drive

1 Turn off the oscilloscope.

2 Make sure a keyboard and mouse are connected to USB host ports.

3 Turn on the oscilloscope and watch closely for the system prompts. As soon as you see the prompt to choose Microsoft Windows or Instrument Image Recovery System, select **Instrument Image Recovery System** and follow the on-screen instructions.

4 From the oscilloscope desktop, launch the Infiniium application. When the application is active, perform an oscilloscope self-test (**Utilities > Self Test...**).

Using the Demo Wizard

Your Infiniium UXR oscilloscope comes with a built-in demo wizard that showcases many Infiniium features. To see the demos, choose **Demos > Tutorials & Demos...**. You can then select a specific demo, such as one for a particular protocol or one for a user interface demo showing bookmarks.

For example, the following screen display shows the initial demo page for the FFT function. To experiment with the demo, click **Load Demo...**.

Using the Online Help

Almost anything you want to know about the Infiniium oscilloscope is available in the online help.

Accessing the Online Help

There are two ways to access the online help:

- Click the question mark near the top right corner of a dialog box to open to the help topic for that dialog box (Figure 22).

- Choose **Help > Help Contents...** from the main menu to open the online help home page (Figure 23).

Displays the Help topic for this dialog box
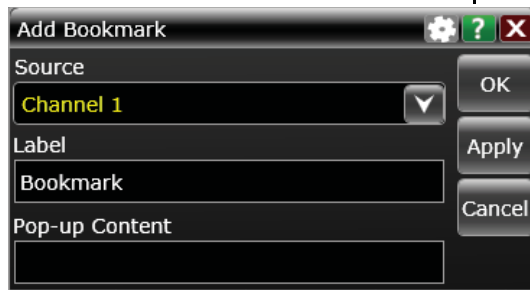
Figure 22   Help button for dialog box help
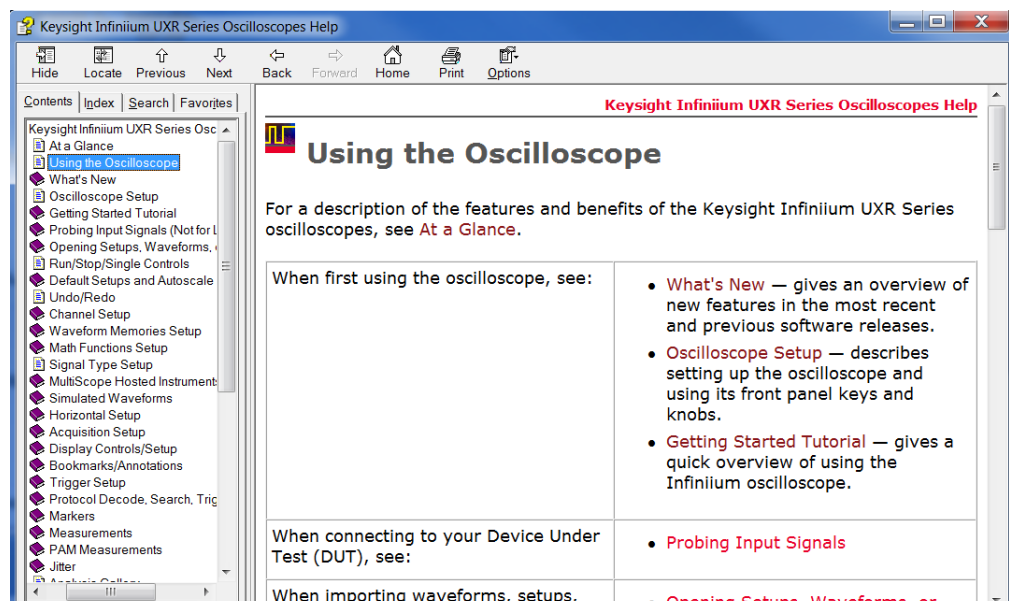
Figure 23   Online Help home page

Navigating the Online Help

There are several ways to find the information you need.

- Use the **Search** tab to search for a word or phrase. Use quotation marks to search for an exact phrase, such as "add waveform".
- Use the **Contents** tab to browse topics by double-clicking topics in the left pane.
- Use the **Index** tab to type in a keyword and search the index for that keyword, or scroll through the alphabetical list to find a topic.
- Use the **Favorites** tab to add preferred help topics to a list for easy reference.

For more details on using online help, click **How to Use This Help** under the **Help and More Information** topic in the **Contents** tab.

3 Calibrating the Oscilloscope

A calibration is an oscilloscope self-adjustment. The purpose of running a calibration is to reach performance optimization.

The calibration of your UXR oscilloscope is known as a frame cal. It performs a complete calibration of the entire oscilloscope, including all channels installed in it, so it can be referenced back to NIST-characterized standards.

A frame calibration requires an N2125A calibration module (for UXR oscilloscopes with 1.0 mm connector types), an N2126A calibration module (for UXR oscilloscopes with 1.85 mm connector types), or an N2127A calibration module (for UXR oscilloscopes with 3.5 mm connector types).

All of the oscilloscope's calibration factors are stored into flash memory (NAND) on the backplane board so that the calibration factors determined by the frame calibration are preserved even if the hard drive is replaced or reformatted.

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When to Perform a Frame Calibration

- · When it has been more than 1 year since the last calibration.
- · When the oscilloscope's operating temperature (after a 30-minute warm-up period) is more than ±5 °C different from that of the last calibration.

Equipment Required

Description	Critical specifications	Recommended part number or product
Calibration module kit	No substitute	N2125A for models with 1.0 mm connector types N2126A for models with 1.85 mm connector types N2127A for models with 3.5 mm connector types
Adapter: 3.5 mm (f) to (f)	No substitute	5061-5311
Adapter: 1.0 mm ruggedized (f) to 2.92 mm (f) **for models with 1.0 mm connector types**	No substitute	5067-1393
Adapter: 2.92 mm to 2.40 mm 50 Ω **for models with 1.85 mm connector types**	No substitute	1250-3782
GPS 10 MHz frequency reference	Output Frequency: 10 MHz, ‹ ±0.1 ppb with no aging	Fluke Electronics 910R GPS Rubidium Frequency Reference

Calibration Module Components

The N2125A and N2126A calibration modules consist of an AutoProbe pod, a remote head, a main cable, and an RF cable.
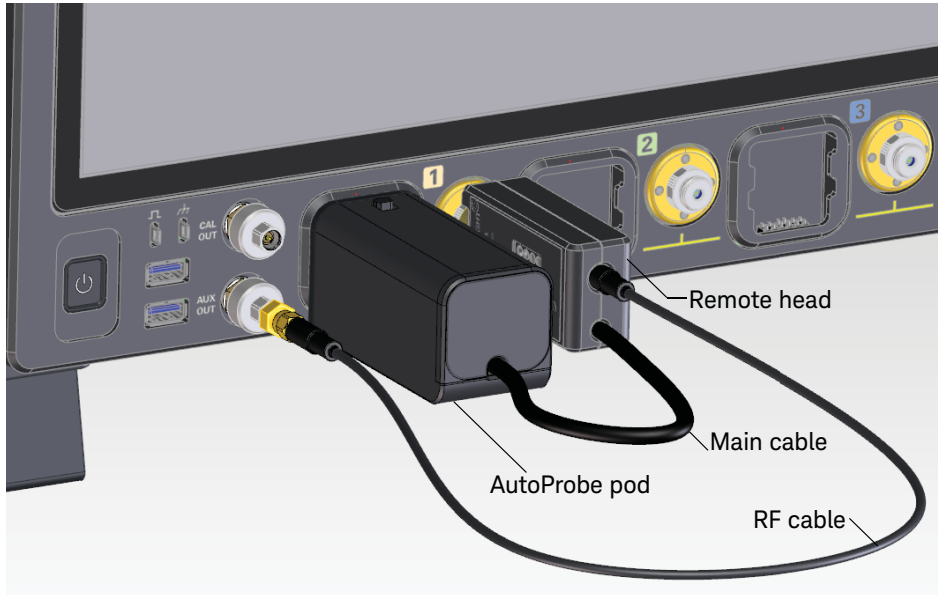
Figure 24   N2125A calibration module connected to UXR oscilloscope with 1.0 mm connector types
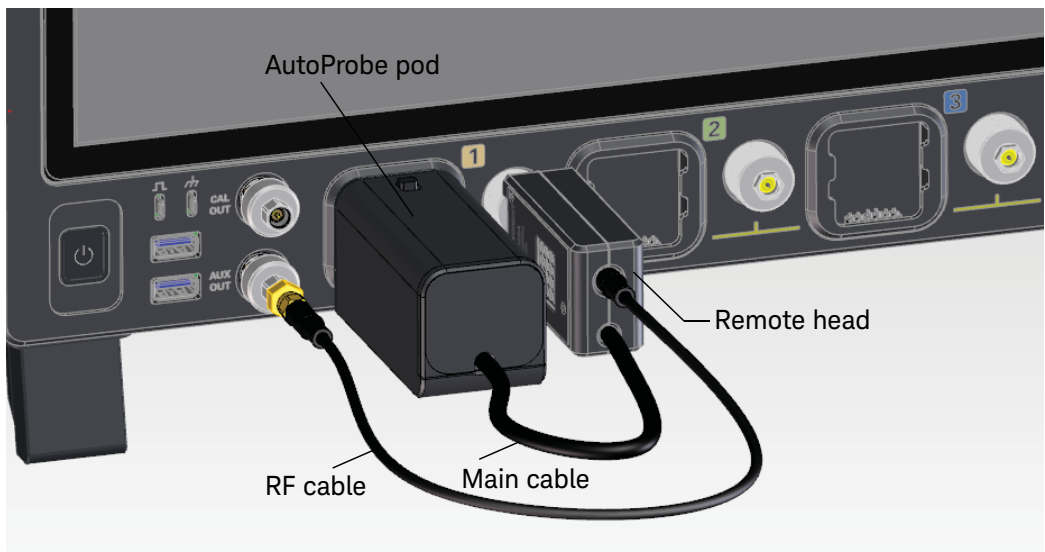
Figure 25   N2126A calibration module connected to UXR oscilloscope with 1.85 mm connector types

The N2127A calibration module is a single unit.
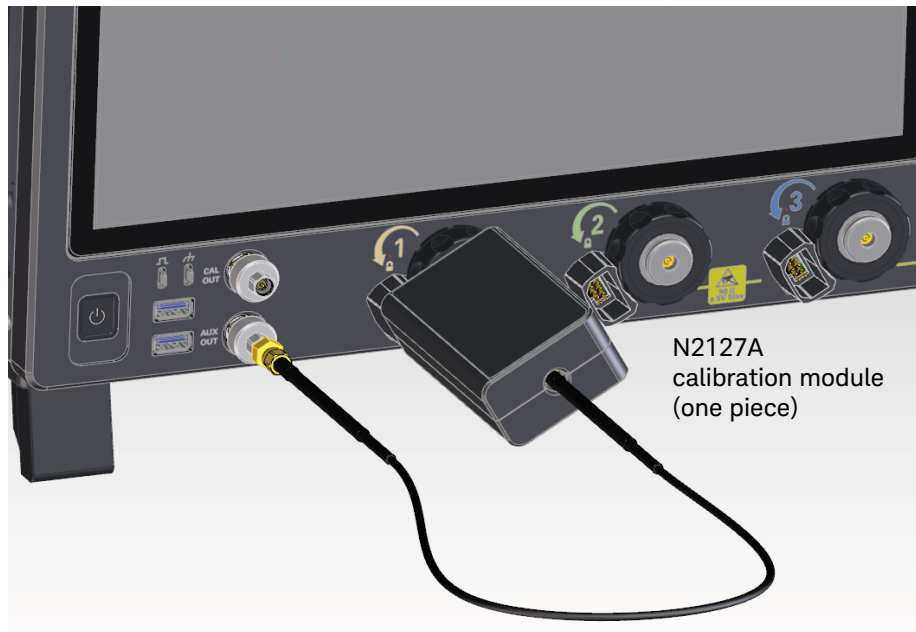
Figure 26   N2127A calibration module connected to UXR oscilloscope with 3.5 mm
connector types

Calibration Time

It takes about 1-1/2 hours to calibrate the first channel, and about an hour per each additional channel, including the time required to change cables from channel to channel.

Calibration Procedure

1 Remove the connector savers from all channels.

2 Connect the calibration module to the oscilloscope. For N2125A and N2126A modules, connect the components in this order:

    a Attach the AutoProbe pod to the AutoProbe 3 interface for channel 1.

    b Connect the RF cable to Aux Out.

    c Attach the remote head to channel 1, using the wrench to apply proper torque.

3 Let the oscilloscope and calibration module warm up before running the cal.

NOTE	Both the calibration module and the oscilloscope must be warmed up (with the Infiniium application running) for at least 30 minutes at ambient temperature before starting the calibration procedure. Failure to allow warm up may result in inaccurate calibration.

4 Click **Utilities > Calibration…**.

5 Clear the **Cal Memory Protect** check box. You cannot run a calibration if this box is selected.

Clear this check box before beginning calibration
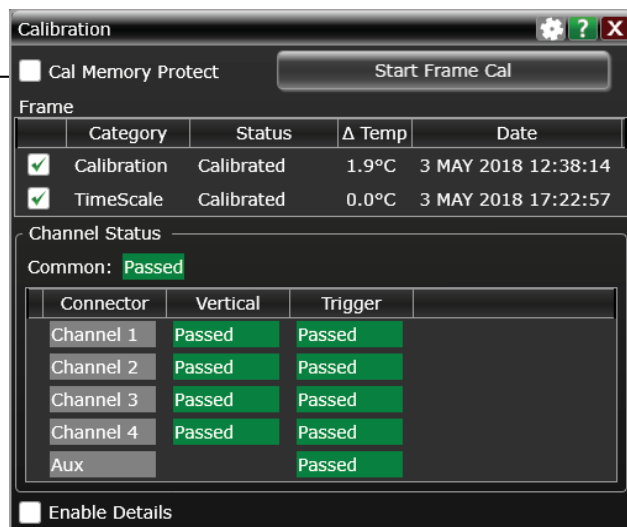
6 To run a calibration without a time scale cal, select only the **Calibration** check box. If you also want to run a time scale calibration, you will need the equipment listed in "Time Scale Accuracy (TSA) Test" on page 98.

7 A dialog box appears, showing an estimated time to complete the calibration. Click **OK**.

8 Click **Start Frame Cal**, then follow the instructions on the screen.

 • You must use the appropriate calibration module for your oscilloscope, and use the appropriate calibration cable with adapters when prompted by the software. Failure to use the appropriate parts will result in an inaccurate calibration.

 • As you move to a new channel, connect the remote head first, then the AutoProbe pod.

 • A Passed/Failed indication appears for each calibration section.

 • If any section has failed, wait until the calibration is complete and then select the **Enable Details** check box for information on the failures. Also check the calibration cables.

9 When the calibration procedure is complete, click **Close**.

4 Troubleshooting

This chapter describes what to do if you encounter any problems with your UXR oscilloscope.

KEYSIGHT
TECHNOLOGIES

Troubleshooting Power Failures

Your Infiniium oscilloscope power/standby switch uses a system of blinks and color to provide diagnostic information about un-commanded shutdowns. If your oscilloscope shuts down unexpectedly or does not power up properly, refer to the following table for guidance:

Power/standby switch color	Meaning/Action to take
Solid amber	The supply is plugged in but the oscilloscope is turned off. Press the switch to turn on the oscilloscope.
Blinking green	If the light had been amber and is now green and blinking, the oscilloscope is in the process of powering on.
	If the light had been green and steady, the blinking indicates it is in the process of powering off. If the bulk supply is very warm, it will blink longer to allow the supply's fans to cool it off. Do not press the button again (it will be ignored).
	Note that if a software update has just occurred, it is possible that the oscilloscope will power itself off briefly and turn itself back on to allow the update to take effect. In this case, the green light will blink continuously until the oscilloscope turns back on.
Blinking amber	A power, fan, or thermal error is preventing the oscilloscope from powering up, or has caused the oscilloscope to turn off. The number of blinks indicates the source of the problem. Call your Keysight service center, and a support person will ask you what the count of blinks is (it will be between 2 and 20).
	For example, 3 or 4 blinks indicates the voltage is too low for your oscilloscope.
Blinking, alternating amber and green	The oscilloscope is storing failure information to flash memory. This process may take several minutes, depending on the source of the failure. Do not unplug the oscilloscope until the switch stops alternating amber/green and starts blinking only amber.

Before You Contact Keysight

If you have any problems with your Infiniium UXR oscilloscope and are contacting Keysight Technologies for assistance, please be ready to provide useful system information such as the current software version and installed options.

To find and save system information, follow these steps:

1 Click **Help > About Infiniium...**.

   A dialog box appears, containing information about the configuration and status of the oscilloscope.

2 Click **Save Support Information**. A zipped file containing useful information is created and saved to the desktop. You can email this file to your Keysight Technical Support representative.

Returning the Oscilloscope to Keysight for Service

Before shipping your oscilloscope for repair, contact Keysight Technologies for details on steps to take. In general, you will follow these steps:

1   Write the following information on a tag and attach it to the oscilloscope.

   · name and address of owner

   · oscilloscope model number

   · oscilloscope serial number (located on the rear of the oscilloscope)

   · description of the service required or failure indications

2   Remove all accessories from the oscilloscope

   Accessories include all cables. Do not include accessories unless they are associated with the failure symptoms.

3   Protect the oscilloscope by wrapping it in plastic or heavy paper.

4   Pack the oscilloscope in its original shipping materials.

   If the original shipping materials are not available, contact your Keysight Sales Office to order a carton designed specifically for your oscilloscope. The part number for the carton assembly is 54964-68701. Seal the shipping container securely.

5   Mark the shipping container as FRAGILE.

In any correspondence, refer to the oscilloscope by model number and full serial number.

5 Testing Performance

Full performance verification for the Infiniium UXR real-time oscilloscopes consists of three main procedures:

1 Performing the internal oscilloscope self-tests to ensure the measurement system is functioning properly. To perform the self tests, click **Utilities > Self Test...**. Then select **Scope SelfTest** from the **Available Self Test** drop-down list box, click **Start**, and follow the instructions on the screen. If any of the self tests fail, ensure that the failure is diagnosed and repaired before calibrating and testing performance.

2 Performing a calibration, as described in Chapter 2.

3 Testing the performance of the oscilloscope to ensure that it is performing to specification. This chapter describes the performance test procedures.

Refer to Table 1 on page 3 to determine the input connector type for your UXR oscilloscope model.

KEYSIGHT
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Performance Verification General Information

Vertical Performance Verification Tests

This chapter describes these vertical performance verification tests:

- Offset Accuracy Test
- DC Gain Accuracy Test
- Analog Bandwidth—Maximum Frequency Test
- Time Scale Accuracy (TSA) Test

Performance Test Interval

The procedures in this section may be performed for incoming inspection and should be performed periodically to verify that the oscilloscope is operating within specification. The recommended test interval is once per year. Performance should also be tested after repairs or major upgrades.

Performance Test Record

A test record form is provided at the end of this chapter. This record lists performance tests and test limits, and provides space to record test results.

Test Order

The tests in this section may be performed in any order. However, we recommend conducting the tests in the order presented, as the order represents an incremental approach to performance verification. This approach may be useful when you are troubleshooting a suspected problem.

Test Equipment

Lists of equipment needed to conduct each test are provided for each test procedure. The procedures are written to minimize the number and types of test equipment and accessories required. The test equipment in these lists are currently available for sale by Keysight or other suppliers at the time this document was written, unless otherwise indicated. In some cases, the test procedures use features specific to the test equipment in the recommended equipment list. However, other equipment, cables, and accessories that satisfy the critical specifications in these lists may be substituted for the recommended models with some modification to the test procedures.

Contact Keysight Technologies for more information about the Keysight products in these lists.

Offset Accuracy Test

NOTE	The oscilloscope under test must be warmed up (with the oscilloscope application running) for at least 30 minutes prior to the start of any performance test.

Specifications

Table 5   Offset Accuracy Specification for Models with 3.5 mm Input Connectors

Offset Accuracy	±1% of channel offset + 1% of full scale
Full scale is defined as 8 vertical divisions. The smallest hardware scale setting is 10 mV/div. Scale settings smaller than the minimum hardware scale setting use software magnification. Below 10 mV/div, full scale is defined as 80 mV. The major scale settings for these models are 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, and 1 V.	

Table 6   Offset Accuracy Specification for Models with 1.85 mm and 1.0 mm Input Connectors

Offset Accuracy	±2% of channel offset + 1% of full scale
Full scale is defined as 8 vertical divisions. The smallest hardware scale setting is 10 mV/div. Scale settings smaller than the minimum hardware scale setting use software magnification. Below 10 mV/div, full scale is defined as 80 mV. The major scale settings for these models are 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, and 500 mV.	

NOTE	The offset accuracy specification has two terms: ±(offset gain + zero error). The offset gain specification is ±N% of channel offset, and the zero error specification is ±N% of full scale. The offset accuracy test procedure tests each of these terms individually.

Equipment Required

Note that 3.5 mm connections are compatible with 2.92 mm and SMA.

Equipment	For testing these oscilloscope models	Critical specifications	Recommended model or part number
Digital multimeter	all	DC voltage measurement accuracy better than ±0.1% of reading	34465A Truevolt DMM 34411A (discontinued)
Cable assembly (2 shielded required)	all	Shielded BNC (m) connectors	8120-1840
Adapter	all	BNC Tee (m)(f)(f)	1250-0781
Adapter	all	BNC (f) to dual banana	1251-2277
Adapter (2 required)	all	SMA (m) to BNC (f)	1250-1200
Adapter	all	50 Ω termination adapter	N8990-80006
Adapter, oscilloscope Cal Out	all	3.5 mm (f) to 3.5 mm (f)	5061-5311
Adapter(s), oscilloscope input	3.5 mm inputs	3.5 mm (f) to 3.5 mm (f)	5061-5311
	1.85 mm inputs	2.4 mm (f) to 3.5 mm (f)	11901B
	1.0 mm inputs	1.0 mm (f) to 2.92 mm (f) adapter 3.5 mm (m) to 3.5 mm (f) adapter	5067-1393 83059C

Zero Error Test Procedure

1 Connect a 50 Ω termination adapter to the oscilloscope's channel 1 input using the adapter(s) for the oscilloscope input described in the table under "Equipment Required" on page 70.

2 Click **Setup > Factory Default**.

3 Click **Setup > Acquisition...**.

4 In the Acquisition dialog box, enable averaging and set **# of Averages** to 256.
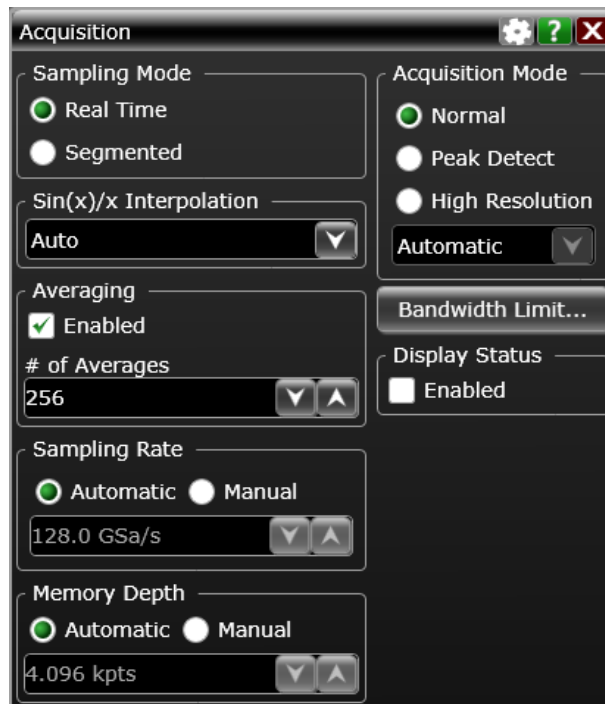
5 Configure the oscilloscope to measure the average voltage (V avg) on channel
1 as follows:

a Change the vertical scale of channel 1 to the oscilloscope's lowest hardware
vertical scale setting (10 mV/div).

b Click the **Vertical Meas** tab on the left side of the screen, then drag and drop
the Average measurement icon onto the channel 1 waveform.

6 Press **[Clear Display]** or click [icon] on the oscilloscope, wait for the measurement
Count value to reach at least 256, and then record the oscilloscope's Mean V
avg reading on .
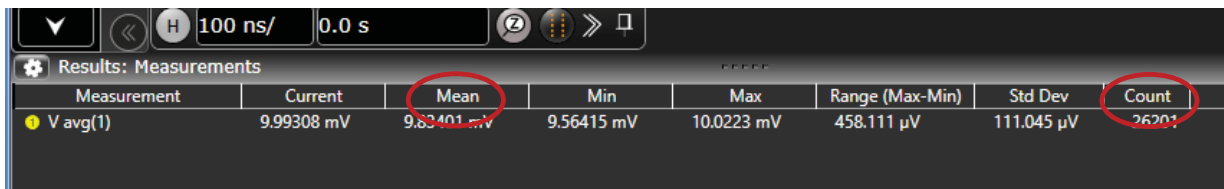
Record the Mean reading   Measurement Count value

NOTE
- For all oscilloscope readings in this procedure, use the Mean value in the Measurement Results area
at the bottom of the screen.
- If a question mark appears in front of any values in the Results area, press **[Clear Display]** on the
oscilloscope, wait for the number of averages to reach at least 256, and then record the oscilloscope
reading. The question mark indicates that the oscilloscope could not make a reliable measurement.

7 Change the vertical scale of channel 1 to the oscilloscope's next larger major scale setting, press **[Clear Display]**, wait for the number of averages to reach at least 256, and then record the V avg reading on .

8 Repeat step 7 for the remaining major vertical scale settings for channel 1.

9 Move the 50 Ω termination adapter to channel 2.

10 Click **Setup > Factory Default**, then turn off channel 1 and turn the channel 2 display on.

11 Configure the oscilloscope to measure the average voltage on channel 2 as follows:

   a Click **Setup > Acquisition...**. In the Acquisition dialog box, enable averaging and set **# of Averages** to 256.

   b Change the vertical scale of channel 2 to the oscilloscope's lowest hardware vertical scale setting.

   c Drag and drop the Average voltage measurement icon from the left side of the screen onto the channel 2 waveform.

12 Press **[Clear Display]** on the oscilloscope, wait for the number of averages to reach at least 256, and then record the oscilloscope's Mean V avg reading for channel 1 10 mV/div on .

13 Repeat steps 11b and 12 for the remaining major vertical scale settings for channel 2.

14 Repeat steps 10 through 13 for any remaining channels.

Offset Gain Test Procedure

1 Make the connections to oscilloscope channel 1 as shown below.

DMM

Cal Out on
oscilloscope
front panel

BNC (f) to dual banana (1251-2277)

3.5 mm (f) to 3.5 mm (f)
adapter (5061-5311)

Oscilloscope input channel

BNC (f) to SMA (m)
adapter (1250-1200)

Adapter(s), oscilloscope input (see equipment table)

BNC (f) to SMA (m) adapter (1250-1200)

BNC (m)(m) cable
(8120-1840)

BNC (m)(m) cable
(8120-1840)

BNC Tee (m)(f)(f)
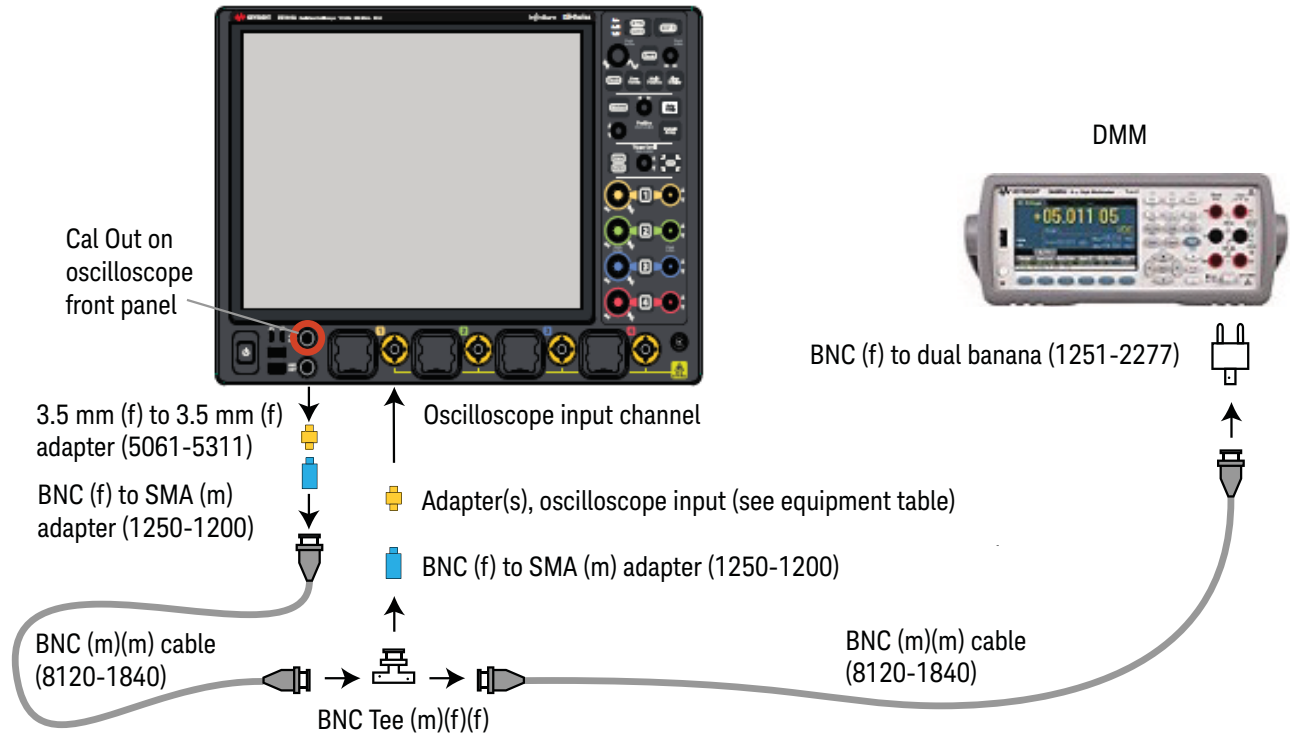
NOTE

- It is important to connect the entire assembly directly to the oscilloscope channel input using the appropriate adapter set to minimize ground potential differences and to ensure that the DMM measures the input voltage to the oscilloscope channel as accurately as possible. The cable should not be between the BNC tee and the oscilloscope input. Differences in ground potential can be a significant source of measurement error, particularly at high oscilloscope sensitivities.

- Connecting the oscilloscope and DMM to the same AC supply circuit also helps to reduce ground potential differences.

- 256 averages are used in the oscilloscope measurements of this section to reduce measurement noise and to reduce the measurement error due to resolution.

2 Set up the DMM to perform DC voltage measurements.

3 Click **Setup** > **Factory Default** on the oscilloscope.

4 Click **Utilities** > **Calibration Output...**.

5 Change the Signal Output function to DC.

6 Configure the oscilloscope to measure the average voltage on the channel under test as follows:

   a Make sure the channel under test is enabled.

   b Click **Setup > Acquisition...**. In the Acquisition dialog box, enable averaging and set **# of Averages** to 256.

7 Drag and drop the Average voltage measurement icon onto the waveform of the channel under test.

8 Set the vertical scale to the oscilloscope's highest setting (1V/div on models with 3.5 mm inputs, 500 mV/div on models with 1.85 mm or 1.0 mm inputs) to prevent input overloads when changing offset values and Calibration Output Levels.

9 For the vertical scale being tested in "Offset Accuracy—Offset Gain Test" on page 103, set the offset value of the channel under test to the corresponding "plus" setting shown in the table (1.2 V for the first time through).

10 Set the Calibration Output Level to the corresponding "plus" setting shown in the table (1.2 V for the first time through).
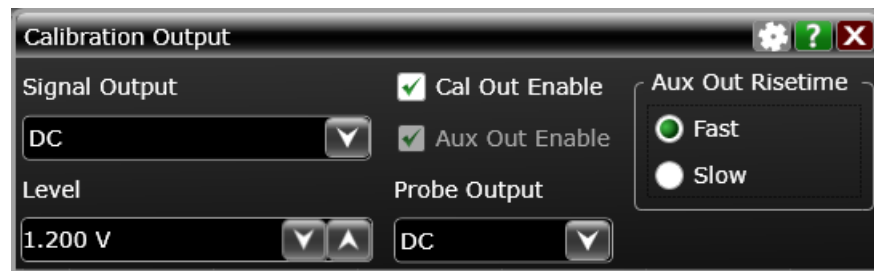
11 Set the vertical scale of the channel under test to the setting shown in the table.

12 Press **[Clear Display]** on the oscilloscope, wait for the number of averages to reach at least 256, and then record the DMM voltage reading as V_{DMM+} and the oscilloscope V avg reading as V_{Scope+} in the table on page 103.

13 Set the vertical scale to the oscilloscope's highest setting (1V/div on models with 3.5 mm inputs, 500 mV/div on models with 1.85 mm or 1.0 mm inputs) to prevent input overloads when changing offset values and Calibration Output Levels.

14 Change the offset value of the channel under test to the corresponding "minus" setting shown in the table (-1.2 V for the first time through).

15 Set the Calibration Output Level to the corresponding "minus" setting shown in the table (-1.2 V for the first time through).

16 Set the vertical scale of the channel under test to the setting shown in the table.

17 Press **[Clear Display]** on the oscilloscope, wait for the number of averages to reach at least 256, and then record the DMM voltage reading as V_{DMM-} and the oscilloscope V avg reading as V_{Scope-} in the table on **page 103**.

18 Set the Calibration Output Level to 0 mV.

19 Change the offset value of the channel under test to 0 mV.

20 Press **[Clear Display]** on the oscilloscope, wait for the number of averages to reach at least 256, and then record the DMM voltage reading as V_{DMM0} and the scope V avg reading as V_{Scope0}.

21 Calculate the offset gain error using the following expressions and record the value. The offset gain error is the greater (maximum magnitude) of either:

$$\left(\frac{V_{scope+} - V_{scope0}}{V_{DMM+} - V_{DMM0}} - 1 \right) 100$$

or:

$$\left(\frac{V_{scope-} - V_{scope0}}{V_{DMM-} - V_{DMM0}} - 1 \right) 100$$

22 Repeat steps **8** through **21** for the remaining major vertical scale settings for the channel under test. Record the results in the table on **page 103**. For each measurement, refer to the results table to find the next highest vertical scale value and corresponding Cal Out voltage ($V_{Cal\ Out}$) and Channel offset voltage (V_{Offset}) value.

23 Move the BNC tee with adapters to the next channel input and repeat steps **3** to **22** for the remaining channels.

DC Gain Accuracy Test

NOTE	The oscilloscope under test must be warmed up (with the oscilloscope application running) for at least 30 minutes prior to the start of any performance test.

Specifications

Table 7   DC Gain Accuracy Specification for Models with 3.5 mm Input Connectors

DC Gain Accuracy	±1.5% of full scale
Full scale is defined as 8 vertical divisions. The smallest hardware scale setting is 10 mV/div. Scale settings smaller than the minimum hardware scale setting use software magnification. Below 10 mV/div, full scale is defined as 80 mV. The major scale settings are 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, and 1 V.	

Table 8   DC Gain Accuracy Specification for Models with 1.85 mm and 1.0 mm Input Connectors

DC Gain Accuracy	±2% of full scale
Full scale is defined as 8 vertical divisions. The smallest hardware scale setting is 10 mV/div. Scale settings smaller than the minimum hardware scale setting use software magnification. Below 10 mV/div, full scale is defined as 80 mV. The major scale settings are 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, and 500 mV.	

Equipment Required

Note that 3.5 mm connections are compatible with 2.92 mm and SMA.

Equipment	For testing these oscilloscope models	Critical specifications	Recommended model or part number
Digital multimeter	all	DC voltage measurement accuracy better than ±0.1% of reading	34465A Truevolt DMM 34411A (discontinued)
Cable assembly (2 shielded required)	all	Shielded BNC (m) connectors	8120-1840
Adapter	all	BNC Tee (m)(f)(f)	1250-0781
Adapter	all	BNC (f) to dual banana	1251-2277
Adapter (2 required)	all	SMA (m) to BNC (f)	1250-1200
Adapter	all	50 Ω termination adapter	N8990-80006
Adapter, oscilloscope Cal Out	all	3.5 mm (f) to 3.5 mm (f)	5061-5311
Adapter(s), oscilloscope input	3.5 mm inputs	3.5 mm (f) to 3.5 mm (f)	5061-5311
	1.85 mm inputs	2.4 mm (f) to 3.5 mm (f)	11901B
	1.0 mm inputs	1.0 mm (f) to 2.92 mm (f) adapter 3.5 mm (m) to 3.5 mm (f) adapter	5067-1393 83059C

Procedure

1 Make the connections to oscilloscope channel 1 as shown below:

Cal Out on
oscilloscope
front panel

DMM

BNC (f) to dual banana (1251-2277)

3.5 mm (f) to 3.5 mm (f)
adapter (5061-5311)

Oscilloscope input channel

BNC (f) to SMA (m)
adapter (1250-1200)

Adapter(s), oscilloscope input (see equipment table)

BNC (f) to SMA (m) adapter (1250-1200)

BNC (m)(m) cable
(8120-1840)

BNC (m)(m) cable
(8120-1840)

BNC Tee (m)(f)(f)
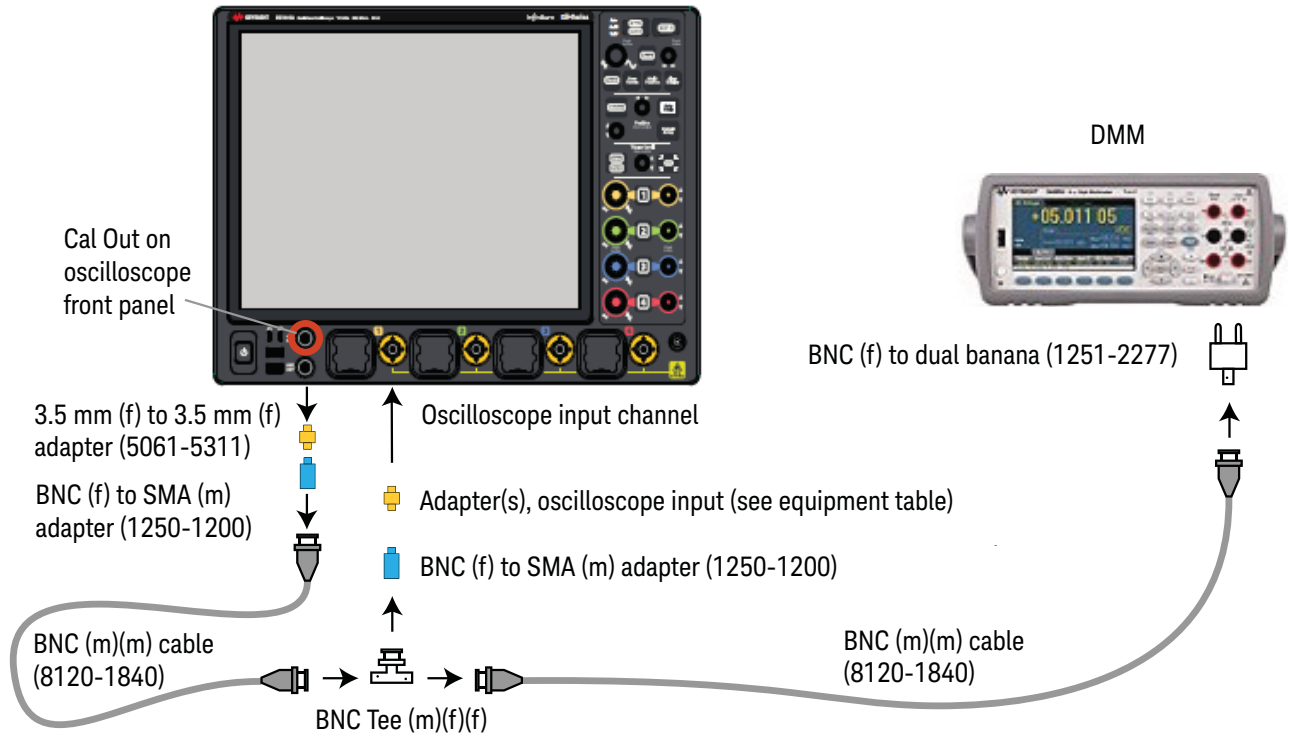
NOTE

- It is important to connect the channel test cable directly to the oscilloscope channel input using the appropriate adapter set to minimize ground potential differences and to ensure that the DMM measures the input voltage to the oscilloscope channel as accurately as possible. Differences in ground potential can be a significant source of measurement error, particularly at high oscilloscope sensitivities.

- Connecting the oscilloscope and DMM to the same AC supply circuit also helps to reduce ground potential differences.

- 256 averages are used in the oscilloscope measurements of this section to reduce measurement noise and to reduce the measurement error due to resolution.

2 Click **Setup > Factory Default**, then configure the oscilloscope as follows:

    a Click **Setup > Acquisition...**.

    a In the Acquisition dialog box, enable averaging and set **# of Averages** to 256.

3 Set the Cal Out voltage ($V_{Cal\ Out}$) as follows:

    a Click **Utilities > Calibration Output...**.

    b Change the Signal Output function to DC.

    c Set the Level to 30 mV.
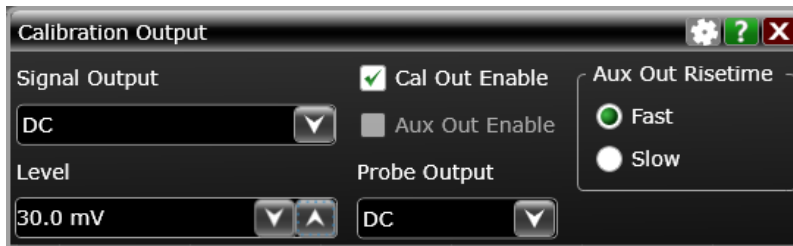
4 Set the vertical scale of the channel under test to the oscilloscope's lowest hardware vertical scale setting (10 mV/div).

5 Drag and drop the Average voltage measurement icon onto the channel 1 waveform.

6 Press **[Clear Display]** on the oscilloscope, wait for the number of averages to reach at least 256, and then record the DMM voltage reading as V_{DMM+} and the oscilloscope V avg reading as V_{Scope+} in the table on .
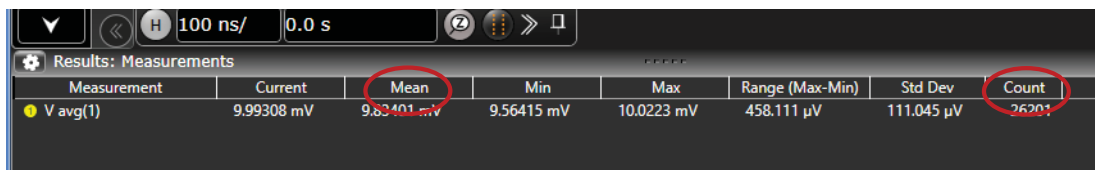
Record the Mean reading   Measurement Count value

NOTE

- For all oscilloscope readings in this procedure, use the Mean value in the Measurement Results area at the bottom of the screen.

- If a question mark appears in front of any of the values in the Results area, press **[Clear Display]** on the oscilloscope, wait for the number of averages to reach at least 256, and then record the oscilloscope reading. The question mark indicates that the oscilloscope could not make a reliable measurement.

7 Change the Cal Out voltage to -30 mV.

8 Press **[Clear Display]** on the oscilloscope, wait for the number of averages to reach at least 256, and then record the DMM voltage reading as V_{DMM-} and the oscilloscope V avg reading as V_{Scope-} in the table on .

9 Calculate the DC gain using the following expression and record this value in the Calculated DC Gain Error column of the table on .

For vertical scale values < 500 mV/div use the following equation:

$$DCGainError = \frac{\Delta V_{out}}{\Delta V_{in}} = \left(\frac{V_{scope+} - V_{scope-}}{V_{DMM+} - V_{DMM-}} - 1\right)75$$

For vertical scale values = 500 mV, use the following equation:

$$DCGainError = \frac{\Delta V_{out}}{\Delta V_{in}} = \left(\frac{V_{scope+} - V_{scope-}}{V_{DMM+} - V_{DMM-}} - 1\right)60$$

For vertical scale values = 1 V/div, use the following equation:

$$DCGainError = \frac{\Delta V_{out}}{\Delta V_{in}} = \left(\frac{V_{scope+} - V_{scope-}}{V_{DMM+} - V_{DMM-}} - 1\right)30$$

10 Repeat steps 3 to 9 for the remaining channel 1 major vertical scale settings in the DC Gain Accuracy Test section of the Performance Test Record. For each measurement, set the Cal Out voltage ($V_{Cal\ Out}$) to the positive $V_{Cal\ Out}$ value and then to the negative $V_{Cal\ Out}$ value in the "$V_{Cal\ Out}$ setting" column of the table on for each vertical scale setting.

11 Move the channel test cable to the next channel input and repeat steps 2 to 10 for the remaining channels.

Analog Bandwidth—Maximum Frequency Test for Warranted Bandwidth from 5 GHz to 67 GHz

| CAUTION | Ensure that the input voltage to the oscilloscope never exceeds the safe operating input voltage range of the oscilloscope. The safe input range is between two divisions below the bottom of the display and two divisions above the top of the display. |

| NOTE | The oscilloscope under test must be warmed up (with the oscilloscope application running) for at least 30 minutes prior to the start of any performance test. |

Specifications

Table 9   Bandwidth Specifications, Warranted Bandwidth from 5 GHz to 67 GHz

Model Number			Input Connectors	Maximum Bandwidth	Warranted Bandwidth (-3 dB)
4 channel	2 channel	1 channel			
n/a	n/a	UXR0051AP	1.0 mm	5 GHz	5 GHz
UXR0104A	n/a	n/a	3.5 mm	10 GHz	10 GHz
UXR0134A	n/a	n/a	3.5 mm	13 GHz	13 GHz
UXR0164A	n/a	n/a	3.5 mm	16 GHz	16 GHz
UXR0204A	n/a	n/a	3.5 mm	20 GHz	20 GHz
UXR0254A	n/a	n/a	3.5 mm	25 GHz	25 GHz
UXR0334A	n/a	n/a	3.5 mm	33 GHz	32 GHz
UXR0404A	UXR0402A	n/a	1.85 mm	40 GHz	40 GHz
UXR0504A	UXR0502A	n/a	1.85 mm	50 GHz	50 GHz
UXR0594A	UXR0592A	n/a	1.85 mm	59 GHz	59 GHz
UXR0704A	UXR0702A	n/a	1.85 mm	70 GHz	67 GHz
UXR0254AP	UXR0252AP	n/a	1.0 mm	25 GHz	25 GHz
UXR0404AP	UXR0402AP	n/a	1.0 mm	40 GHz	40 GHz
UXR0594AP	UXR0592AP	n/a	1.0 mm	59 GHz	59 GHz

Equipment Required

Table 10 Equipment Required for testing Warranted Bandwidth from 5 GHz to 67 GHz

Fig 24 Label	Equipment	For testing these oscilloscope models	Critical specifications	Recommended model or part
(a)	Microwave CW generator	5 GHz - 33 GHz	Output impedance = 50 Ω Power range: -25 dBm to +25 dBm Frequency range: 50 MHz to 32 GHz	E8257D Opt 540
		40 GHz - 70 GHz	Output impedance = 50 Ω Power range: -25 dBm to +25 dBm Frequency range: 50 MHz to 67 GHz	E8257D Opt 567
(b)	Power meter	all	Power sensor compatibility	N1912A
(c)	Power sensor	5 GHz - 33 GHz	Frequency range: 50 MHz to 32 GHz Power range: -24 dBm to +20 dBm	N1922A
		40 GHz - 70 GHz	Frequency range: 50 MHz to 67 GHz Power range: -24 dBm to +20 dBm	N8488A
(d)	Power splitter	5 GHz - 33 GHz	2 Resistor Power Splitter Max frequency ≥ 32 GHz	11667C
		40 GHz - 70 GHz	2 Resistor Power Splitter Max frequency ≥ 67 GHz	Anritsu V241C The performance of the Anritsu V241C power splitter is guaranteed by Anritsu up to 65 GHz only. However, Keysight Calibration Services can be used to verify the specified performance up to 67 GHz for use with 70 GHz UXR models, if desired.
(e)	Microwave cable	5 GHz - 33 GHz	50 Ω characteristic Impedance 2.4 mm (m) to 2.4 mm (m) connectors Max Frequency ≥ 32 GHz	N5180-60204
		40 GHz - 70 GHz	50 Ω characteristic Impedance 1.85 mm (m) to 1.85 mm (m) connectors Max Frequency ≥ 67 GHz	Junkosha MWX061

Table 10 Equipment Required for testing Warranted Bandwidth from 5 GHz to 67 GHz (continued)

Fig 24 Label	Equipment	For testing these oscilloscope models	Critical specifications	Recommended model or part
(f)	Adapter(s), oscilloscope input	3.5 mm inputs	2.4 mm (m) to 3.5 mm (f)	11901C
		1.85 mm inputs	No adapter needed, Anritsu V241C splitter output connects directly to the oscilloscope input	n/a
		1.0 mm inputs, 5 GHz - 25 GHz	1.0 mm (rugged f) to 2.92 mm (f)	Y1903B
			2.4 mm (m) to 2.92 mm (m)	11904A
		1.0 mm inputs, 40 GHz - 70 GHz	1.0 mm (rug f) to 1.85 mm (f)	Y1901B
			1.85 mm (m) to 1.85 mm (m)	N5520A
(g)	Adapter, microwave CW generator output	5 GHz - 33 GHz	2.4 mm (f) to 2.4 mm (f)	11900B
		40 GHz - 70 GHz	1.85 mm (f) to 1.85 mm (f)	N5520B
(h)	Adapter, splitter input	5 GHz - 33 GHz	No adapter needed, microwave cable connects directly to 11667C splitter input	n/a
		40 GHz - 70 GHz	1.85 mm (f) to 1.85 mm (f)	N5520B

Equipment Connections
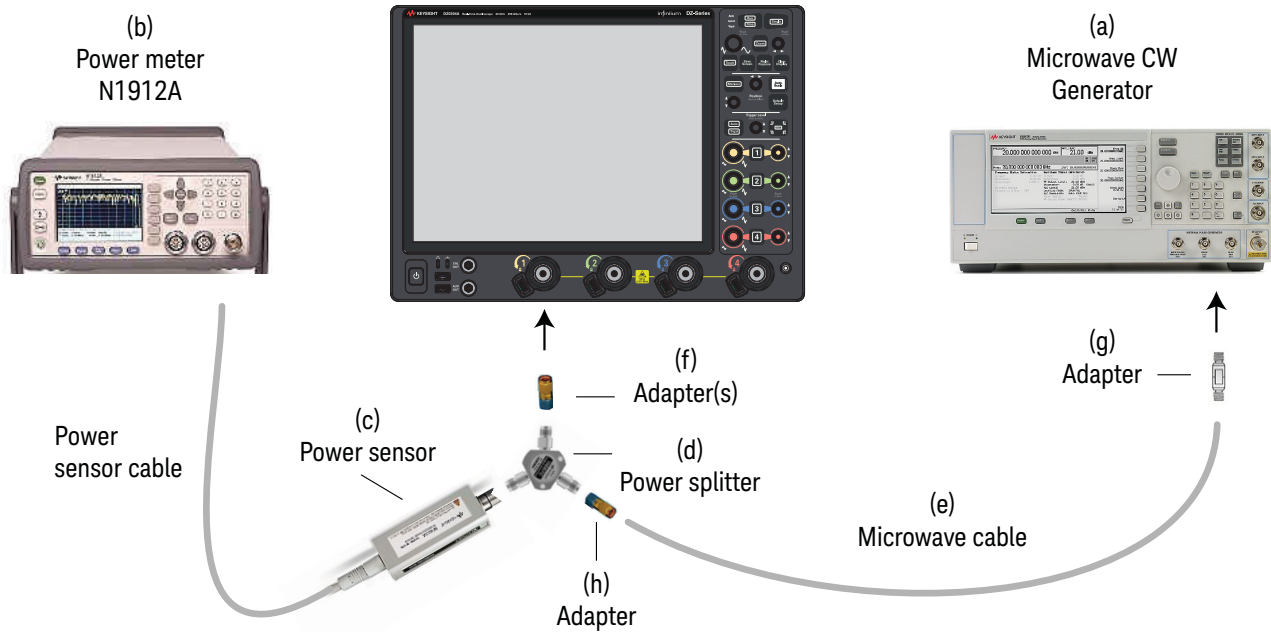
Figure 27   Equipment Connections for testing Warranted Bandwidth from 5 GHz to 67 GHz

NOTE	▪ Connect one output of the (d) power splitter to the oscilloscope Channel N input using the (f) adapter(s), without any additional cabling or adapters.
	▪ Connect the (c) power sensor directly to the other output of the (d) power splitter without any additional cabling or adapters.
	▪ Connect the (e) microwave cable directly to the input of the (d) power splitter without any additional cabling or adapters.
	▪ Minimize the use of any additional adapters.
	▪ Ensure that the connectors are tightened properly. See "Applying Torque" on page 21.

Procedure

1 Preset the power meter.

2 Connect the power sensor to the power meter's Power Ref connector, then zero and calibrate the meter.

3 Make the connections to oscilloscope channel 1 as shown in the preceding connection diagram for your oscilloscope model.

4 Set the frequency of the power meter to 50 MHz.

5 Click **Setup > Factory Default**, then configure the oscilloscope as follows:

a Set the vertical scale of the channel under test to 10 mV/div.

b Set the horizontal scale to 20 ns/div (to display 10 cycles of a 50 MHz waveform).
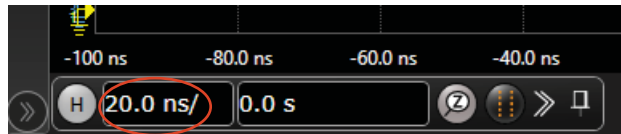
Enter the
horizontal scale

c Click **Measure/Mark > Add Measurement...**.

d In the Add Measurement dialog box, select the Vertical RMS measurement and configure it as follows:

Source	Channel 1
Measurement Area	Entire Display
RMS Type	AC
Units	dBm
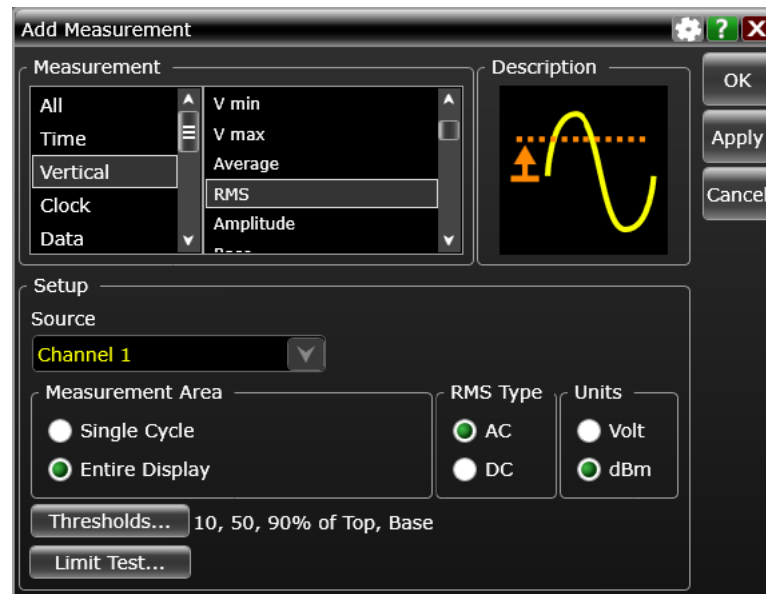
6 Set the generator to produce a 50 MHz sine wave with an output power of –20 dBm.

   Adjust the generator's output power setting such that the peak-to-peak amplitude of the oscilloscope's displayed waveform is an close to 4 divisions as possible.

7 Adjust the offset to center the signal on the screen, if necessary.

8 Use the power meter to measure the input power delivered to the oscilloscope channel in dBm.

   Record the input power value in the P_{in} @ 50 MHz column of the table on page 105.

9 Press **[Clear Display]** on the oscilloscope and record the oscilloscope's measured power (in dBm) in the P_{meas} @ 50 MHz column of the table on page 105.

<table>
<tr><td>**NOTE**</td><td>For all oscilloscope readings in this procedure, use the Mean value in the Measurement Results area at the bottom of the screen.</td></tr>
</table>

10 Change the generator frequency to the warranted bandwidth for the UXR model being tested as shown in the following table.

Model Number			Maximum Frequency
4 channel	2 channel	1 channel	
n/a	n/a	UXR0051AP	5 GHz
UXR0104A	n/a	n/a	10 GHz
UXR0134A	n/a	n/a	13 GHz
UXR0164A	n/a	n/a	16 GHz
UXR0204A	n/a	n/a	20 GHz
UXR0254A	n/a	n/a	25 GHz
UXR0334A	n/a	n/a	32 GHz
UXR0404A	UXR0402A	n/a	40 GHz
UXR0504A	UXR0502A	n/a	50 GHz
UXR0594A	UXR0592A	n/a	59 GHz
UXR0704A	UXR0702A	n/a	67 GHz
UXR0254AP	UXR0252AP	n/a	25 GHz
UXR0404AP	UXR0402AP	n/a	40 GHz
UXR0594AP	UXR0592AP	n/a	59 GHz

11 Adjust the generator's output power setting such that the peak-to-peak amplitude of the oscilloscope's displayed waveform is as close to 4 divisions as possible.

12 Use the power meter to measure the input power delivered to the oscilloscope channel in dBm.

Record the input power in the P_{in} @ Max Freq column on .

13 Press **[Clear Display]** on the oscilloscope and record the oscilloscope's measured power (in dBm) in the P_{meas} @ Max Freq column on .

14 Calculate the attenuation at the maximum frequency using the expression:

Atten = (P_{meas}@50 MHz - P_{meas}@MaxFreq) - (P_{in}@50 MHz - P_{in}@MaxFreq)

Record this value in the Attenuation @Max Freq column on . To pass this test, this value must be less than +3.0 dB.

15 Change the channel vertical scale to the oscilloscope's next larger major vertical scale setting (20 mV/div).

16 Change the generator output as follows:

   a Reset the generator back to a frequency of 50 MHz.

   b Adjust the generator's output power setting such that the peak-to-peak amplitude of the oscilloscope's displayed waveform is as close to 4 divisions as possible.

17 Repeat steps 8 and 9 to measure the input and measured signal power at 50 MHz for this scale setting.

18 Repeat steps 10 through 14 to compute the oscilloscope's attenuation at maximum frequency for this vertical scale setting.

19 Repeat steps 15 through 18 to compute the oscilloscope's attenuation at maximum frequency for the remaining major vertical scale settings.

20 Move the power splitter to channel 2 and change the oscilloscope configuration as follows:

   a Press **[Default Setup]**.

   b Ensure Channel 2 is displayed and all other channels are turned off.

   c Set the vertical scale of channel 2 to 10mV/div.

   d Set the horizontal scale to 20 ns/div (to display 10 cycles of a 50 MHz waveform).

   e Click **Trigger > Setup Trigger...** and change the source to channel 2.

   f Click **Measure > Add Measurement...**. Select the RMS voltage measurement, Channel 2 as the source, Entire Display as the Measurement Area, dBm for the units, and AC for the RMS Type.

21 Repeat steps 6 to 19 to complete measuring the oscilloscope's attenuation at maximum frequency for channel 2.

22 If the oscilloscope has two channels only, the test procedure is completed; otherwise, continue with the following steps.

23 Move the power splitter to channel 3 and change the oscilloscope configuration as follows:

   a Press **[Default Setup]**.

   b Ensure Channel 3 is displayed and all other channels are turned off.

   c Set the vertical scale of channel 3 to 10 mV/div.

   d Set the horizontal scale to 20 ns/div (to display 10 cycles of a 50 MHz waveform).

   e Click **Trigger > Setup Trigger...** and change the source to channel 3.

   f Click **Measure > Add Measurement...**. Select the RMS voltage measurement, Channel 3 as the source, Entire Display as the Measurement Area, dBm for the units, and AC for the RMS Type.

24 Repeat steps 6 to 19 to complete measuring the oscilloscope's attenuation at maximum frequency for channel 3.

25 Move the power splitter to channel 4 and change the oscilloscope configuration as follows:

a Press **[Default Setup]**.

b Ensure Channel 4 is displayed and all other channels are turned off.

c Set the vertical scale of channel 4 to 10 mV/div.

d Set the horizontal scale to 20 ns/div (to display 10 cycles of a 50 MHz waveform).

e Click **Trigger > Setup Trigger...** and change the source to channel 4.

f Click **Measure > Add Measurement...**. Select the RMS voltage measurement, Channel 4 as the source, Entire Display as the Measurement Area, dBm for the units, and AC for the RMS Type.

Repeat steps 6 to 19 to complete measuring the oscilloscope's attenuation at maximum frequency for channel 4.

Analog Bandwidth—Maximum Frequency Test for Warranted Bandwidth from 70 GHz to 110 GHz

CAUTION	Ensure that the input voltage to the oscilloscope never exceeds the safe operating input voltage range of the oscilloscope. The safe input range is between two divisions below the bottom of the display and two divisions above the top of the display.

NOTE	The oscilloscope under test must be warmed up (with the oscilloscope application running) for at least 30 minutes prior to the start of any performance test.

Specifications

Table 11 Bandwidth Specification, Warranted Bandwidth from 70 GHz to 110 GHz

Model Number		Input Connector	Maximum Bandwidth	Warranted Bandwidth (-3 dB)
4 channel	2 channel			
UXR0704AP	UXR0702AP	1.0 mm	70 GHz	70 GHz
UXR0804A	UXR0802A	1.0 mm	80 GHz	80 GHz
UXR1004A	UXR1002A	1.0 mm	100 GHz	100 GHz
UXR1104A	UXR1102A	1.0 mm	110 GHz	110 GHz

Equipment Required

Equipment	Critical specifications	Recommended model or part
Microwave cable	50 Ω characteristic Impedance 1.0 mm (f) to 1.0 mm (f) connectors ≥ 110 GHz	W.L. Gore CX0AA0AAC20.0
Power sensor	≥ 110 GHz Compatible with network analyzer	Keysight U8489A
Network analyzer	≥ 110 GHz ≥ 2 port Calibrated output power	Keysight N5290A
Calibration kit	≥ 110 GHz	Keysight 85059B 1 mm cal kit

Equipment Connections

Network analyzer

USB cable

Power sensor

Microwave cable

UXR-Series oscilloscope > 70 GHz bandwidth
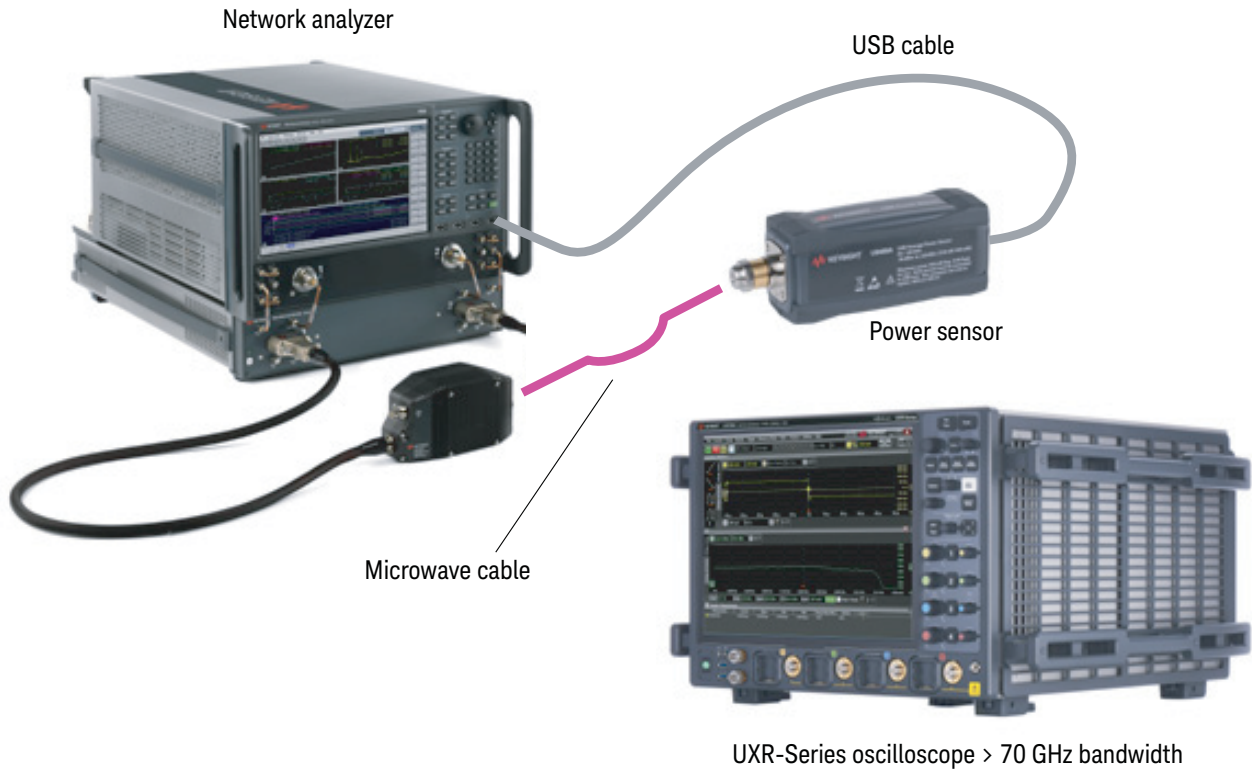
Figure 28   Equipment Connections for testing Warranted Bandwidth from 70 GHz to 110 GHz

> **NOTE**
> - Minimize the use of any additional adapters.
> - Ensure that the connectors are tightened properly. See "Applying Torque" on page 21.

Procedure

Here is an overview of the procedure before you start following the steps:

As the oscilloscope's vertical scale increases, the network analyzer output power must be increased to drive the oscilloscope's input with a 4-division peak-to-peak input signal. Table 12 shows the appropriate calibrated network analyzer output power for each of the oscilloscope's vertical scale settings.

Table 12 Calibrated network analyzer output power for each vertical scale setting

V/div	Network analyzer output power	Notes
0.010	-24 dBm	
0.020	-18 dBm	
0.050	-10 dBm	
0.100	-4 dBm	
0.200	+2 dBm	If the network analyzer fails its power calibration due to lack of output power at these levels (depending on the cable used), back off and use the next lower power level that will calibrate successfully.
0.500	+10 dBm	

For each new oscilloscope V/div and network analyzer output power setting, the network analyzer's output power needs to re-calibrated using the power sensor. Because of this, the procedure will test all channels at a particular V/div and output power setting before moving to the next.

To perform the test:

1   Perform a 2-channel calibration on the network analyzer.

2   Connect the power sensor's USB cable to the network analyzer's USB port.

3   Initialize the power sensor using the network analyzer's **Power Sensor Setup** menu.

4   Ensure nothing is connected to the power sensor. Then, zero and calibrate the power sensor.

5   Connect the microwave cable to port 1 of the network analyzer.

6   Configure the network analyzer to measure S11 at two frequency points, 50 MHz and the oscilloscope's warranted bandwidth, which can be found in Table 11 on page 91.

Make sure you configure the sweep for two points only, so you can easily step between the two points.

7   Set the network analyzer **Source Power Level** to the value appropriate for the oscilloscope's V/div setting being tested (see Table 12).

For example, for the 0.010 V/div setting, set the power level to -24 dBm.

8   Connect the power sensor to the microwave cable.

9   Perform a **Source Power** calibration on the network analyzer.

If the network analyzer fails its power calibration due to lack of output power at the +2 dBm or +10 dBm levels (depending on the cable used), back off and use the next lower power level that will calibrate successfully.

10 Configure the network analyzer's trigger to **Manual Point** mode:

a **Trigger Source** = Manual

b **Trigger Scope** = Channel

c **Trigger Mode** = Point
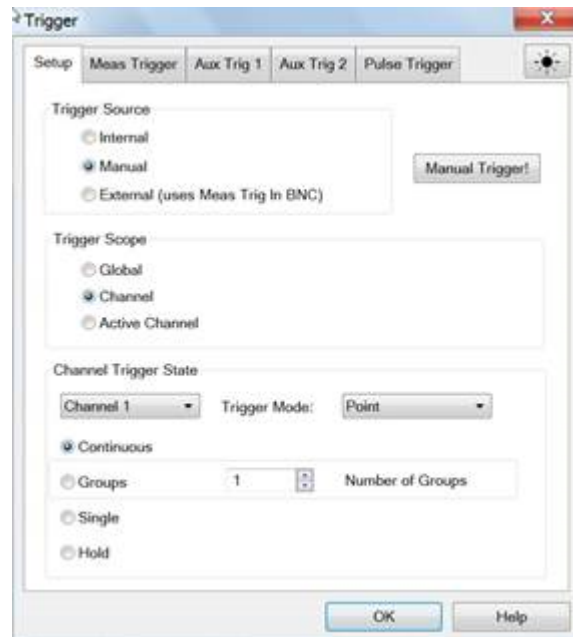
11 From the oscilloscope's main menu, choose **Setup > Factory Default**. Then, configure the oscilloscope as follows:

   a Set the vertical scale of the channel under test to the V/div under test (10 mV/div the first time through).

   b Set the horizontal scale to 20 ns/div (to display 10 cycles of a 50 MHz waveform).
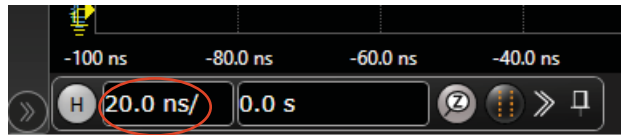
Enter the
horizontal scale

   c Choose **Measure/Mark > Add Measurement...**.

   d In the Add Measurement dialog box, select the Vertical RMS measurement and configure it as follows:

Source	Channel 1
Measurement Area	Entire Display
RMS Type	AC
Units	dBm
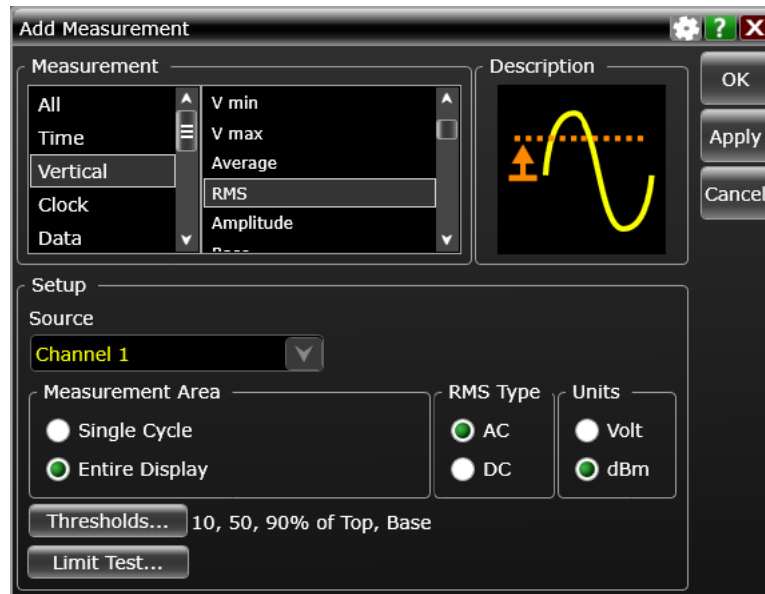
12 Disconnect the microwave cable from the power sensor and connect it to the oscilloscope's channel under test input.

13 Press the **Manual** button in the network analyzer's Trigger Setup menu until the network analyzer's output frequency equals 50 MHz.

14 Adjust the offset to center the signal on the screen, if necessary.

15 Press **[Clear Display]** on the oscilloscope and record the oscilloscope's measured power (in dBm) in the P$_{meas}$ @ 50 MHz column on page 106.

NOTE For all oscilloscope readings in this procedure, use the Mean value in the Measurement Results area at the bottom of the screen.

16 Press the **Manual** button in the network analyzer's Trigger Setup menu once. Ensure that the network analyzer's output frequency is equal to the warranted bandwidth for the UXR model being tested as shown in the following table.

Model Number		Maximum Frequency
4 channel	2 channel	
UXR0704AP	UXR0702AP	70 GHz
UXR0804A	UXR0802A	80 GHz
UXR1004A	UXR1002A	100 GHz
UXR1104A	UXR1102A	110 GHz

17 Press **[Clear Display]** on the oscilloscope and record the oscilloscope's measured power (in dBm) in the P$_{meas}$ @ Max Freq column on page 106.

18 Calculate the attenuation at the maximum frequency using the expression:

Atten = (P$_{meas}$@50 MHz – P$_{meas}$@MaxFreq)

Record this value in the Attenuation @Max Freq column on page 106. To pass this test, this value must be less than +3.0 dB.

19 Move the microwave cable to the next channel under test, and change the oscilloscope configuration as follows:

a Press **[Default Setup]**.

b Ensure the channel under test is displayed and all other channels are turned off.

c Set the vertical scale of the channel under test to the V/div setting under test (10 mV/div the first time through).

d The horizontal scale should remain at 20 ns/div (to display 10 cycles of a 50 MHz waveform).

e Click **Trigger > Setup Trigger...** and change the source to the channel under test.

f Click **Measure > Add Measurement...**. Select the RMS voltage measurement, with the channel under test as the source, Entire Display as the Measurement Area, dBm for the units, and AC for the RMS Type.

20 Repeat steps 13 through 19 until all oscilloscope input channels have been tested at the V/div setting under test.

21 Repeat steps 7 through 20 for the next V/div setting under test and its appropriate network analyzer output power level (see Table 12).

22 When all V/div settings in Table 12 have been tested, the test procedure is completed.

Time Scale Accuracy (TSA) Test

This procedure verifies the maximum TSA specification for the oscilloscope.

Description

TSA refers to the absolute accuracy of an oscilloscope's time scale. Because TSA depends directly on frequency of a crystal oscillator, it is comprised of two components: an initial setting accuracy component and an aging component.

The initial setting accuracy component applies to the oscilloscope's 10 MHz OCXO frequency accuracy immediately after a calibration, whether performed at the factory, by a customer, or by a Keysight service center. The aging component applies to change in frequency from the time since the last time scale calibration and adds to the initial setting accuracy component.

Specifications

TSA is published as a warranted specification, expressed by the following formula. The aging component is specified by the 10 MHz OCXO manufacturer while the initial setting accuracy component is derived from absolute frequency measurements of the 10 MHz OCXO in a large sample of production units after a time scale calibration prior to shipment. **These measurements require the 10 MHz OCXO to be powered on for a minimum of 2 hours. The OCXO is powered on any time the oscilloscope is connected to an active AC power source.** Longer is better to further reduce the uncertainty and allow the OCXO frequency to settle onto the aging trajectory of the crystal inside the oscillator.

TSA = ±(25 ppb initial + 100 ppb/year aging) first year of manufacture

±(25 ppb initial + 30 ppb/year aging) after first year of manufacture

To see the number of years since the last time scale calibration, open the oscilloscope application and click **Utilities > Calibration...**. The TimeScale entry in the Calibration dialog box shows the date of the last time scale calibration.

Equipment Required

Description	For testing these oscilloscope models	Critical specifications	Recommended model/ part number
Synthesized sine wave source	all	Output Frequency: ≥ 11 MHz Output Amplitude: 0 dBm Frequency Resolution: 0.1 Hz	E8257D PSG, any bandwidth option
10 MHz frequency reference	all	Output Frequency: 10 MHz Output Amplitude: 0 dBm to 10 dBm Absolute Freq. accuracy: < ±1 ppb	GPS or equivalent 10 MHz reference
RF cable (2 required)	all	50 Ω characteristic impedance, BNC (m) connectors	8120-1840
Adapters, PSG RF Out	all	If using a PSG with 3.5 mm output connector, use: 3.5 mm (f) to 3.5 mm (f) adapter	5061-5311
		If using a PSG with 2.4 mm or 1.85 mm output connector, use: 2.4 mm (f) to 3.5 mm (f) adapter	11901B
		SMA (m) to BNC (f) adapter	1250-1200
Adapters, oscilloscope input	all	SMA (m) to BNC (f) adapter	1250-1200
	3.5 mm inputs	3.5 mm (f) to 3.5 mm (f)	5061-5311
	1.85 mm inputs	2.4 mm (f) to 3.5 mm (f)	11901B
	1.0 mm inputs	1.0 mm (f) to 2.92 mm (f) adapter 3.5 mm (m) to 3.5 mm (f) adapter	5067-1393 83059C

Connections

GPS or equivalent
10 MHz Frequency
Reference

E8257D PSG
Sine Wave Source

10 MHz from GPS (or
equivalent) reference
connected to the
10 MHz IN port
on rear panel.
Must be 0-10 dBm.

10 MHz
Out

RF Out

RF (BNC) cable
8120-1840 or equivalent

Adapters, PSG RF Out (see equipment table)

RF (BNC) cable
8120-1840 or equivalent

Adapters, oscilloscope input
(see equipment table)
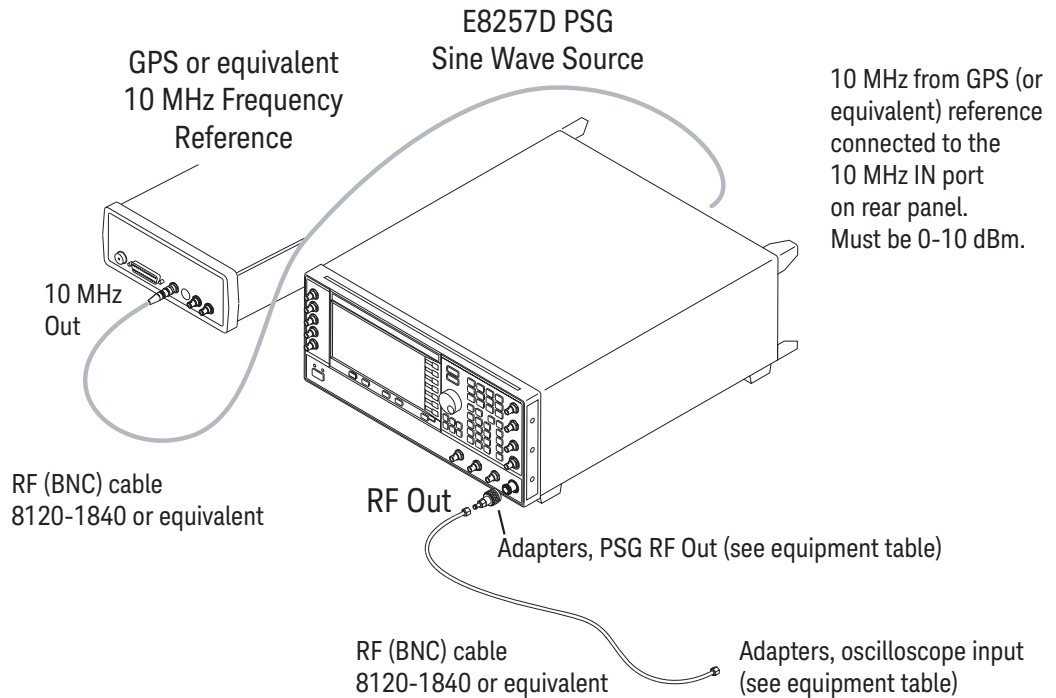
Procedure

1 Make the connections to the oscilloscope and test equipment as shown in the preceding figure.

2 Make sure the 10 MHz OCXO has been powered on for at least 2 hours, preferably longer if possible.

3 Configure the E8257D sine wave source to output a 0 dBm (633 mVpp) sine wave into 50 ohms with a frequency of 10.00002000 MHz. **Note: Make sure the E8257D is locked to the GPS or equivalent reference.** The EXT REF indicator on the E8257D will be on when locked.

4 Click **Setup > Factory Default** on the oscilloscope.

5 Set the vertical scale of channel 1 to 100 mV/div.

6 Set the oscilloscope sampling rate to 1 MSa/s (**Setup > Acquisition...**). (The resulting measurement will be aliased.)

7 Set the horizontal scale of the oscilloscope to 20 ms/div.

8 Set the measurement thresholds for all waveforms to a fixed voltage level of 0 V and ±20 mV hysteresis:

   a Click **Measure > Thresholds...**.

   b Select Custom: level +/- hysteresis from the Thresholds drop-down list box.

   c Enter 20 mV in the Hysteresis field and 0 V in the Threshold Level field.

9 Enable a frequency measurement on channel 1.

10 On the oscilloscope, press **[Stop]**.

11 Press **[Clear Display]**.

12 Press **[Run]**, wait until 10 acquisitions have accumulated, and then press **[Stop]**.

13 Convert the average frequency value to time scale error by subtracting 20 Hz and dividing by 0.01 Hz/ppb. Record the result in the Measured Time Scale Error (ppb) column of the Time Scale Accuracy table.

14 Record the time since the previous calibration (in years) in the table. Click **Utilities > Calibration...** to find the most recent Time Scale calibration.

15 Calculate the specification for Time Scale Accuracy based on the oscilloscope's last time scale calibration using the following formula:

   TSA = ±(25 ppb initial + 100 ppb/year aging) first year of manufacture

          ±(25 ppb initial + 30 ppb/year aging) after first year of manufacture

16 Compare the measured time scale error to the TSA specification.

17 Record the results in the Performance Test Record.

Performance Test Record

Keysight Technologies	**Keysight Infiniium UXR Oscilloscopes**
Model Number _____	Tested by_____
Serial Number _____	Work Order No._____
Recommended Test Interval—1 Year	Date_____
Recommended next test date _____	Ambient temperature _____

Offset Accuracy—Zero Error Test

Vertical scale	Test limits	Channel 1	Channel 2	Channel 3	Channel 4
10 mV/div	-0.8 mV to +0.8 mV				
20 mV/div	-1.6 mV to +1.6 mV				
50 mV/div	-4.0 mV to +4.0 mV				
100 mV/div	-8.0 mV to +8.0 mV				
200 mV/div	-16.0 mV to +16.0 mV				
500 mV/div	-40.0 mV to +40.0 mV				
1 V/div**	-80.0 mV to +80.0 mV				
** 1 V/div not available on models with 1.85 mm or 1.0 mm inputs					

Offset Accuracy—Offset Gain Test

Vertical scale	$V_{Cal\ Out}$ V_{Offset} setting	V_{DMM+}	V_{Scope+}	V_{DMM-}	V_{Scope-}	V_{DMM0}	V_{Scope0}	Calc. offset gain error	Offset gain error test limits
Channel 1									
1 V/div**	±1.2 V								*
500 mV/div	±1.2 V								*
200 mV/div	±1.2 V								*
100 mV/div	***								*
50 mV/div	±400 mV								*
20 mV/div	±400 mV								*
10 mV/div	±400 mV								*
Channel 2									
1 V/div**	±1.2 V								*
500 mV/div	±1.2 V								*
200 mV/div	±1.2 V								*
100 mV/div	***								*
50 mV/div	±400 mV								*
20 mV/div	±400 mV								*
10 mV/div	±400 mV								*
Channel 3									
1 V/div**	±1.2 V								*
500 mV/div	±1.2 V								*
200 mV/div	±1.2 V								*
100 mV/div	***								*
50 mV/div	±400 mV								*
20 mV/div	±400 mV								*
10 mV/div	±400 mV								*
Channel 4									
1 V/div**	±1.2 V								*
500 mV/div	±1.2 V								*
200 mV/div	±1.2 V								*
100 mV/div	***								*
50 mV/div	±400 mV								*
20 mV/div	±400 mV								*
10 mV/div	±400 mV								*
* ±1% for models with 3.5 mm inputs, ±2% for models with 1.85 mm or 1.0 mm inputs									
** 1 V/div is not available on models with 1.85 mm or 1.0 mm inputs									
*** ±1.2 V for models with 3.5 mm inputs, ±700 mV for models with 1.85 mm or 1.0 mm inputs									

DC Gain Accuracy Test

Vertical scale	$V_{Cal\ Out}$ setting	V_{DMM+}	V_{Scope+}	V_{DMM-}	V_{Scope-}	Calc. DC gain error	DC gain error test limits
Channel 1							
10 mV/div	±30 mV						*
20 mV/div	±60 mV						*
50 mV/div	±150 mV						*
100 mV/div	±300 mV						*
200 mV/div	±600 mV						*
500 mV/div	±1.2 V						*
1 V/div**	±1.2 V						*
Channel 2							
10 mV/div	±30 mV						*
20 mV/div	±60 mV						*
50 mV/div	±150 mV						*
100 mV/div	±300 mV						*
200 mV/div	±600 mV						*
500 mV/div	±1.2 V						*
1 V/div**	±1.2 V						*
Channel 3							
10 mV/div	±30 mV						*
20 mV/div	±60 mV						*
50 mV/div	±150 mV						*
100 mV/div	±300 mV						*
200 mV/div	±600 mV						*
500 mV/div	±1.2 V						*
1 V/div**	±1.2 V						*
Channel 4							
10 mV/div	±30 mV						*
20 mV/div	±60 mV						*
50 mV/div	±150 mV						*
100 mV/div	±300 mV						*
200 mV/div	±600 mV						*
500 mV/div	±1.2 V						*
1 V/div**	±1.2 V						*
* ±1.5% for models with 3.5 mm inputs, ±2% for models with 1.85 mm or 1.0 mm inputs							
** 1 V/div is not available on models with 1.85 mm or 1.0 mm inputs							

Analog Bandwidth—Maximum Frequency Test for Warranted Bandwidth from 5 GHz to 67 GHz

Vertical scale	Measurement				Attenuation@ Max Freq Test Limit ≤ +3 dB
	P_{in} @ 50 MHz	P_{meas}@ 50 MHz	P_{in} @ Max Freq	P_{meas} @ Max Freq	
Channel 1					
10 mV/div					
20 mV/div					
50 mV/div					
100 mV/div					
200 mV/div					
500 mV/div					
1 V/div**					
Channel 2					
10 mV/div					
20 mV/div					
50 mV/div					
100 mV/div					
200 mV/div					
500 mV/div					
1 V/div**					
Channel 3					
10 mV/div					
20 mV/div					
50 mV/div					
100 mV/div					
200 mV/div					
500 mV/div					
1 V/div**					
Channel 4					
10 mV/div					
20 mV/div					
50 mV/div					
100 mV/div					
200 mV/div					
500 mV/div					
1 V/div**					
** 1 V/div is not available on models with 1.85 mm or 1.0 mm inputs					

Analog Bandwidth—Maximum Frequency Test for Warranted Bandwidth from 70 GHz to 110 GHz

Vertical scale	Measurement		Attenuation@ Max Freq Test Limit ≤ +3 dB
	P_{meas}@ 50 MHz	P_{meas} @ Max Freq	
Channel 1			
10 mV/div			
20 mV/div			
50 mV/div			
100 mV/div			
200 mV/div			
500 mV/div			
Channel 2			
10 mV/div			
20 mV/div			
50 mV/div			
100 mV/div			
200 mV/div			
500 mV/div			
Channel 3			
10 mV/div			
20 mV/div			
50 mV/div			
100 mV/div			
200 mV/div			
500 mV/div			
Channel 4			
10 mV/div			
20 mV/div			
50 mV/div			
100 mV/div			
200 mV/div			
500 mV/div			

Time Scale Accuracy Test

Measured Time Scale Error (ppb)	Years since calibration (years)	Low test limit (ppb)	High test limit (ppb)	Pass/Fail

6 Reference Information

This chapter provides additional information for safely using and maintaining your Infiniium UXR oscilloscope.

KEYSIGHT
TECHNOLOGIES

Safety Information

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The documentation contains information and warnings that users must follow to ensure safe operation and to maintain the product in a safe condition.

Safety Compliance

This product complies with the current editions of the following standards:

- CAN/CSA-C22.2 No. 61010-1-12
- ANSI/UL Std. No. 61010-1:2012

Acoustic Statement

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung -3.GSGV Deutschland).

Acoustic Noise Emission/Geraeuschemission	
LpA <70 dB	LpA <70 dB
Operator position	am Arbeitsplatz
Normal position per ISO 7779	normaler Betrieb nach DIN 45635 t.19

This oscilloscope also conforms to EU Machine Directive 2006/42/EC.

General Safety Notices

WARNING | **This is a Safety Protection Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING | **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used only in a normal condition (in which all means for protection are intact).**

WARNING   **Capacitors inside the oscilloscope may retain a charge even if the oscilloscope is disconnected from its source of supply.**

WARNING   **Avoid exposed circuits. To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.**

WARNING   **No operator-serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.**

CAUTION   This product is designed for use in Overvoltage Category II and Pollution Degree 2, per IEC 61010 3rd edition.

The Rayovac BR2032 lithium battery is to be replaced by Keysight service personnel only.

Regulatory Markings

These symbols may be used on the Infiniium oscilloscope.

Symbol	Description
	The RCM mark is a registered trademark of the Australian Communications and Media Authority.
ICES/NMB-001 ISM GRP 1-A ccr.keysight@keysight.com	The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives. ICES/NMB-001 indicates that this ISM device complies with the Industry Canadian Interference-Causing Equipment Standard (ICES-001). Cet appareil ISM est conforme a la norme NMB-001 du Canada. ISM GRP.1 Class A indicates that this is an Industrial Scientific and Medical Group 1 Class A product.
	This symbol indicates separate collection for electrical and electronic equipment mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive 2002/96/EC).
40	This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.
	The symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001. To return unwanted products, contact your local Keysight office.
C US	The CSA mark is a registered trademark of CSA Group.
MSIP-REM-Kst-1A17452	South Korean Certification (KC) mark; includes the marking's identifier code.

Specifications and Characteristics

Table 13 Infiniium UXR oscilloscope specifications and characteristics

Model	Weight	Dimensions (including handles and feet)
UXR0802A, UXR1002A, UXR1102A, UXR0402A, UXR0502A, UXR0592A, UXR0702A, UXR0051AP, UXR0252AP, UXR0402AP, UXR0592AP, UXR0702AP	36.15 kg (79.7 lbs)	Height: 330 mm (13 in) Width: 533 mm (21 in) Depth: 584 mm (23 in)
UXR0804A, UXR1004A, UXR1104A, UXR0404A, UXR0504A, UXR0594A, UXR0704A, UXR0254AP, UXR0404AP, UXR0594AP, UXR0704AP	42.05 kg (92.7 lbs)	Height: 330 mm (13 in) Width: 533 mm (21 in) Depth: 584 mm (23 in)
UXR0104A, UXR0134A, UXR0164A, UXR0204A, UXR0254A, UXR0334A	37.56 kg (82.8 lbs)	Height: 330 mm (13 in) Width: 533 mm (21 in) Depth: 584 mm (23 in)

For a complete list of specifications and characteristics on the Infiniium UXR real-time oscilloscopes, refer to the data sheet at www.keysight.com/find/UXR.

Environmental Conditions

The following table shows the general environmental requirements for this oscilloscope.

Environment	Indoor use only
Ambient temperature	Operating: 5 °C to +40 °C up to 2,000 meters, de-rated between 2,000 and 3,000 meters by 1 °C for every 100 meters
	Non-operating: –20 °C to +70 °C
Humidity	Operating: up to 95% relative humidity (non-condensing) up to +40 °C
	Non-operating: up to 90% relative humidity at +65 °C
Altitude	Operating: up to 3,000 meters (9,842 feet); de-rate maximum temperature by 1 °C for every 100 meters above 2,000 meters
	Non-operating: up to 4,600 meters (15,090 feet)
Overvoltage category	II
Measurement category	The Infiniium UXR oscilloscopes are not intended to be used for measurements in Measurement Category II, III, or IV.
Pollution degree	The Infiniium UXR oscilloscopes may be operated in environments of Pollution Degree 2.
Pollution degree definitions	Pollution Degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. Example: A clean room or climate-controlled office environment.
	Pollution Degree 2: Normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation may occur. Example: General indoor environment.
	Pollution Degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation, which is expected. Example: Sheltered outdoor environment.

Oscilloscope Measurement Category

WARNING **Use this instrument only for measurements within its specified overvoltage category (not rated for CAT II, III, IV). No transient overvoltages are allowed.**

Measurement Category Definitions

The "Not rated for CAT II, III, IV" measurement category is for measurements performed on circuits not directly connected to MAINS. Examples are measurements on circuits not derived from MAINS, and specially protected

(internal) MAINS-derived circuits. In the latter case, transient stresses are variable; for that reason, the transient withstand capability of the equipment is made known to the user.

Measurement category II is for measurements performed on circuits directly connected to the low voltage installation. Examples are measurements on household appliances, portable tools and similar equipment.

Measurement category III is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to the fixed installation.

Measurement category IV is for measurements performed at the source of the low-voltage installation. Examples are electricity meters and measurements on primary over-current protection devices and ripple control units.

Cleaning the Oscilloscope

WARNING | **To prevent electrical shock, disconnect the Infiniium oscilloscope from mains before cleaning.**

Clean the external case parts of the Infiniium oscilloscope with a soft dry cloth or one slightly dampened with a mild soap and water solution. Do not attempt to clean internally.

CAUTION | Do not use too much liquid in cleaning the oscilloscope. Water can enter the Infiniium panels, damaging sensitive electronic components.

To avoid electrostatic discharge (ESD), wear a grounded wrist strap when cleaning connectors.

WARNING | **Use alcohol to clean connectors. The power cord must be removed, and the oscilloscope must be in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to powering up the oscilloscope. Dispose of the cleaning materials in a responsible manner.**

Declaration of Conformity

For Declarations of Conformity for Keysight products, go to www.keysight.com/go/conformity.

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