Performance Verification

Tektronix

CSA7000B Series Communication Signal Analyzers & TDS7000B Series Digital Phosphor Oscilloscopes (CSA7404B, TDS7704B, TDS7404B, TDS7254B, & TDS7154B)

Part of 071-1227-03 **September 8, 2005**

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Performance Verification

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

- To rapidly confirm that the instrument functions and was adjusted properly, just do the brief procedures under *Self Tests*, which begin on page 4–5.

  Advantages. These procedures are quick to do, require no external equipment or signal sources, and perform extensive functional and accuracy testing to provide high confidence that the instrument will perform properly. They can be used as a quick check before making a series of important measurements.

- To further check functionality, first do the *Self Tests* just mentioned; then do the brief procedures under *Functional Tests* that begin on page 4–6.

  Advantages. These procedures require minimal additional time to perform, require no additional equipment other than a BNC cable and BNC-to-SMA adapter or a TCA-BNC adapter, and these procedures more completely test the internal hardware of the instrument. They can be used to quickly determine if the instrument is suitable for putting into service, such as when it is first received.

- If more extensive confirmation of performance is desired, do the *Performance Tests*, beginning on page 4–17, after doing the *Functional* and *Self Tests* mentioned above.

  Advantages. These procedures add direct checking of the warranted specifications that are marked with the ✓ symbol. These procedures require specific test equipment. (See *Table 4–2: Test equipment* on page 4–18).

If you are not familiar with operating this instrument, read the instrument reference or user manuals or explore the online help.

Conventions

Throughout these procedures the following conventions apply:

- Each test procedure uses the following general format:

  Title of Test

  Equipment Required

  Prerequisites

  Procedure

- Each procedure consists of as many steps, substeps, and subparts as required to do the test. Steps, substeps, and subparts are sequenced as follows:

  1. First Step
     a. First Substep
        - First Subpart
        - Second Subpart

     b. Second Substep
  2. Second Step

- In steps and substeps, the lead-in statement in italics instructs you what to do, while the instructions that follow tell you how to do it, as in the example step below:

  Initialize the instrument: Push the front-panel **DEFAULT SETUP** button.

STOP*. The* ***STOP*** *notation at the left is accompanied by information you must read to do the procedure properly.*

- The term “toolbar” refers to a row of buttons at the top of the display. The term “menu bar” refers to a row of menus at the top of the display. You can switch between toolbar and menu bar operating modes by pushing the button near the top right corner of the display. See Figure 4–1.

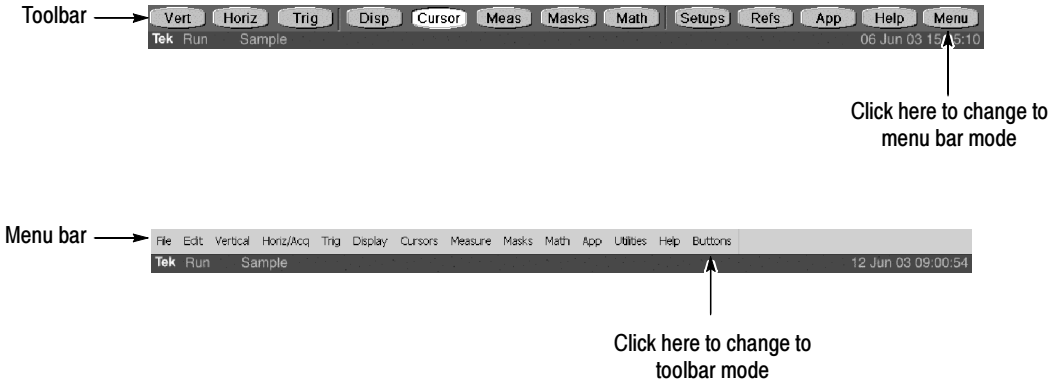

Figure 4-1: Toolbar and menu bar (CSA7000B Series shown)

- The procedures assume you have connected a mouse to the instrument so you can click on the screen controls. If you have not connected a mouse, you can use the touch screen to operate all the screen controls.

Brief Procedures

The *Self Tests* use internal routines to confirm basic functionality and proper adjustment. No test equipment is required to do these test procedures.

The *Functional Tests* utilize the probe-compensation output at the front panel as a test-signal source for further verifying that the instrument functions properly. A BNC cable and a BNC-to-SMA adaptor or a TCA-BNC adapter are required to do these test procedures.

Self Tests

This procedure uses internal routines to verify that the instrument functions and was adjusted properly. No test equipment or hookups are required.

Verify Internal Adjustment, Self Compensation, and Diagnostics

Equipment required	None
Prerequisites	Power on the instrument and allow a 20 minute warm-up before doing this procedure.

1. *Verify that internal diagnostics pass:* Do the following substeps to verify passing of internal diagnostics.

   a. *Display the System diagnostics menu:*

      - If the instrument is in toolbar mode, click the **MENU** button to put the instrument into menu bar mode.
      - Pull down the **Utilities** menu and select **Instrument Diagnostics. . .** . This displays the diagnostics control window.

   b. *Run the System Diagnostics:*

      - First disconnect any input signals from all four channels.
      - Click the **Run** button in the diagnostics control window.

   c. *Wait:* The internal diagnostics do an exhaustive verification of proper instrument function. This verification may take several minutes. When the verification is finished, the resulting status will appear in the diagnostics control window.

***NOTE**. If diagnostic error message 512 is displayed, run signal-path compensation and then rerun Instrument Diagnostics.*

d. *Verify that no failures are found and reported on-screen.* All tests should pass.

e. *Run the signal-path compensation routine:*

- Pull down the **Utilities** menu and select **Instrument Calibration. . .** . This displays the instrument calibration control window.
- If required because the instrument is in service mode, select the **Signal Path** button under Calibration Area.
- Click the **Calibrate** button to start the routine.

f. *Wait:* Signal-path compensation may take five to fifteen minutes to run.

g. *Confirm signal-path compensation returns passed status:* Verify that the word ***Pass*** appears in the instrument calibration control window.

2. *Return to regular service:* Click the **Close** button to exit the instrument calibration control window.

Functional Tests

The purpose of these procedures is to confirm that the instrument functions properly. The only equipment required is a P7240 probe (P7260 probe with TDS7704B), a probe calibration and deskew fixture, a BNC cable, BNC-to-SMA adapter or TCA-BNC adapter, and, to check the file system, a 3.5 inch, 1.44 Mbyte, formatted floppy disk.

***STOP**. These procedures verify functions; that is, they verify that the instrument features operate. They do not verify that they operate within limits.*

Therefore, when the instructions in the functional tests that follow call for you to verify that a signal appears on-screen "that is about five divisions in amplitude" or "has a period of about six horizontal divisions," etc., do NOT interpret the quantities given as limits. Operation within limits is checked in Performance Tests*, which begin on page 4–17.*

STOP*. DO NOT make changes to the front-panel settings that are not called out in the procedures. Each verification procedure will require you to set the instrument to certain default settings before verifying functions. If you make changes to these settings, other than those called out in the procedure, you may obtain invalid results. In this case, just redo the procedure from step* ***1****.*

When you are instructed to press a front-panel or screen button, the button may already be selected (its label will be highlighted). If this is the case, it is not necessary to press the button.

Verify All Input Channels

Equipment required	One P7240 probe (P7260 probe for TDS7704B) One 067-0405-xx (067-0484-xx for TDS7704B) probe calibration and deskew fixture One BNC cable, such as Tektronix part number 012-0076-xx or the cable that came with the deskew fixture (012-0208-xx)
Prerequisites	None

1. *Initialize the instrument:*Push the front-panel **DEFAULT SETUP** button.
2. *Hook up the signal source:* Connect the equipment as shown in Figure 4–2 to the channel input you want to test (beginning with CH 1).

NOTE*. If a probe is not available, connect the probe compensation output to the channel input using a BNC cable and adapters.*

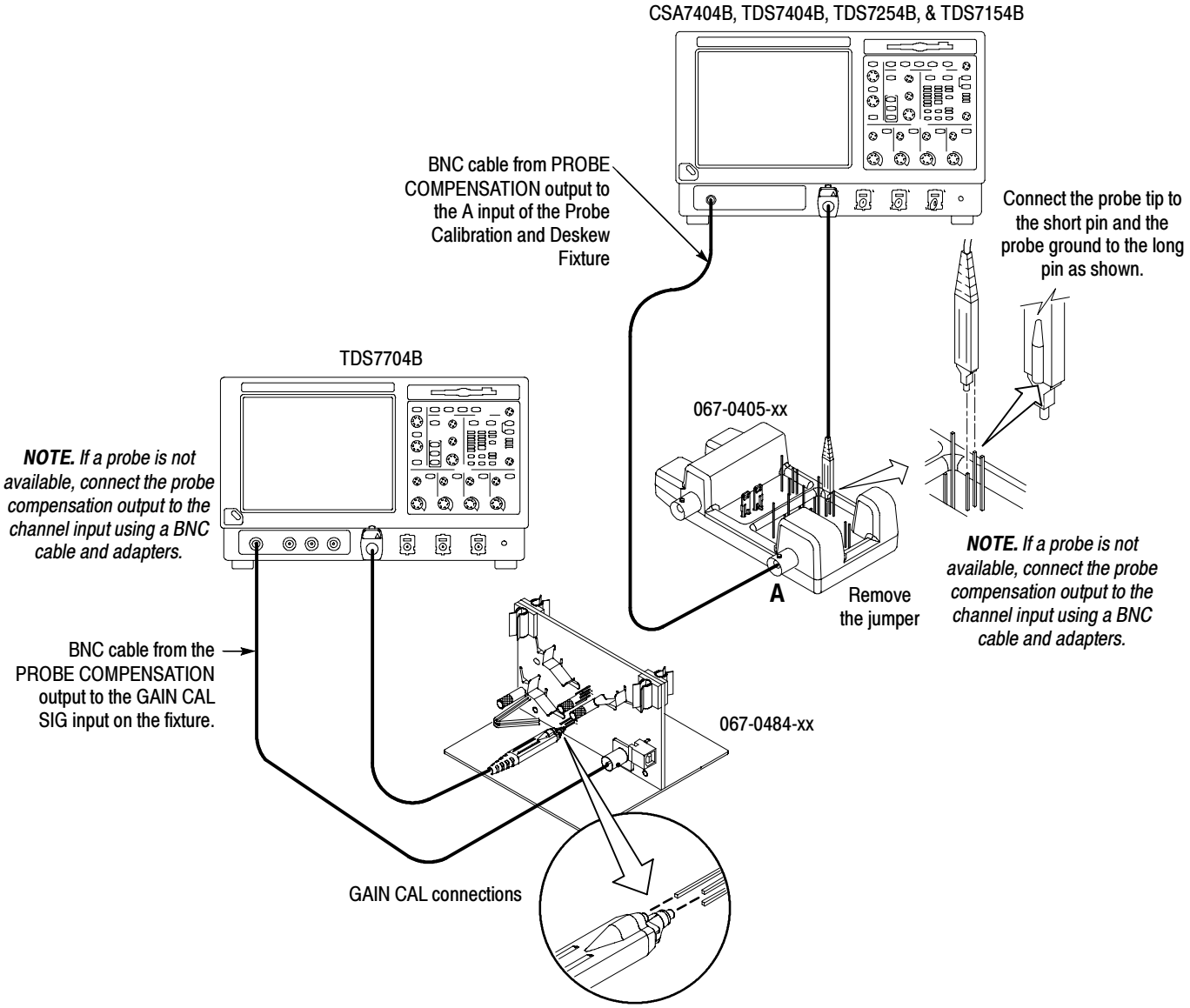

Figure 4-2: Universal test hookup for functional tests - CH 1 shown

3. *Turn off all channels:*If any of the front-panel channel buttons are lighted, push those buttons to turn off the displayed channels. See Figure 4–3.

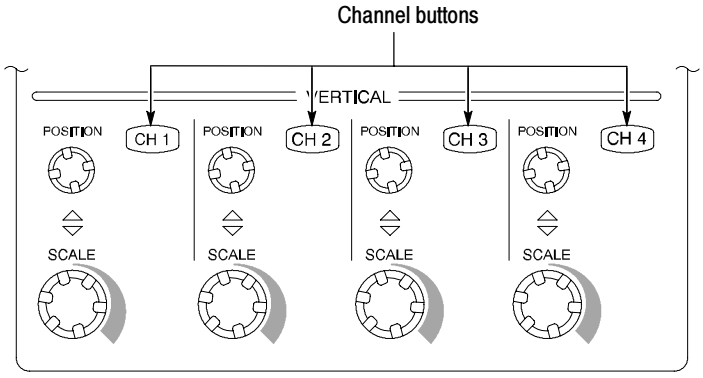

Figure 4-3: Channel button location

4. *Select the channel to test:* Push the channel button for the channel you are currently testing. The button lights and the channel display comes on.
5. *Set up the instrument:*
   - Push the front panel **AUTOSET** button. This sets the horizontal and vertical scale and vertical offset for a usable display and sets the trigger source to the channel you are testing.
   - Pull down the **Vert** menu, select Vertical Setup, and then touch **Offset**. Confirm that the Ch1 Offset is about **-0.18 to -0.54 V**, depending on the probe used (0.0 V if not using a probe).
6. *Verify that the channel is operational:* Confirm that the following statements are true.
   - Verify that the vertical scale readout and the waveform amplitude for the channel under test are as shown in Table 4–1.

Table 4-1: Vertical settings

	CSA7404B, TDS7404B, TDS7254B, TDS7154B, & TDS7704B	
Setting	**With P7240 or P7260**	**Without probe**
Scale	200 mV	200 mV
Waveform amplitude	5.2 divisions	-2.5 divisions

   - The front-panel vertical **POSITION** knob (for the channel you are testing) moves the signal up and down the screen when rotated.

- Turning the vertical **SCALE** knob counterclockwise (for the channel you are testing) decreases the amplitude of the waveform on-screen, turning the knob clockwise increases the amplitude, and returning the knob to the original scale setting returns the amplitude to that shown in Table 4–1 for that scale setting.

7. *Verify that the channel acquires in all acquisition modes:* Pull down the **Horiz/Acq** menu to select **Horizontal/Acquisition Setup. . .** . Click the **Acquisition** tab in the control window that displays. Click each of the acquisition modes and confirm that the following statements are true.

   - Sample mode displays an actively acquiring waveform on-screen. (Note that there is a small amount of noise present on the square wave).
   - Peak Detect mode displays an actively acquiring waveform on-screen with the noise present in Sample mode "peak detected."
   - Hi Res mode displays an actively acquiring waveform on-screen with the noise that was present in Sample mode reduced.
   - Average mode displays an actively acquiring waveform on-screen with the noise reduced.
   - Envelope mode displays an actively acquiring waveform on-screen with the noise displayed.
   - Waveform Database mode displays an actively acquiring waveform on-screen with the noise displayed.

8. *Test all channels:* Repeat steps **2** through **7** until all four input channels are verified.

9. *Remove the test hookup:* Disconnect the equipment from the channel input and the probe compensation output.

Verify the Time Base

Equipment required	One BNC cable, such as Tektronix part number 012-0076-00 One TCA-BNC adapter
Prerequisites	None

1. *Initialize the instrument:*Push the front-panel **DEFAULT SETUP** button.

2. *Hook up the signal source:* Connect the BNC cable from the probe compensation output to the CH 1 input through a TCA-BNC adapter as shown in Figure 4–4.

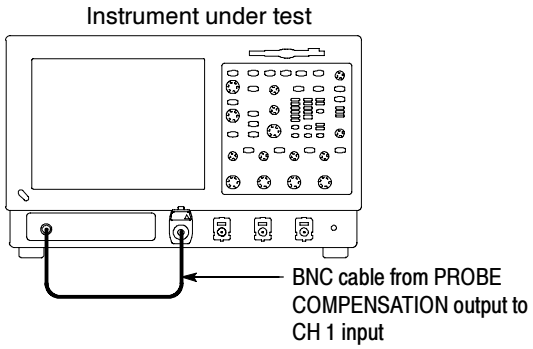

Figure 4- 4: Setup for time base test

3. *Set up the instrument:* Push the front panel **AUTOSET** button.
4. Pull down the **Vert** menu, select Vertical Setup, and then touch **Offset**. Adjust the Ch1 Offset to **-0.25 V** using the multipurpose knob.
5. Set the **Vertical SCALE** to **100 mV** per division.
6. *Set the time base:* Set the horizontal **SCALE** to **200 µs/div**. The time-base readout is displayed at the bottom of the graticule.
7. *Verify that the time base operates:* Confirm the following statements.
   - One period of the square-wave probe-compensation signal is about five horizontal divisions on-screen for the 200 µs/div horizontal scale setting.
   - Rotating the horizontal **SCALE** knob clockwise expands the waveform on-screen (more horizontal divisions per waveform period), counter-clockwise rotation contracts it, and returning the horizontal scale to 200 µs/div returns the period to about five divisions.
   - The horizontal **POSITION** knob positions the signal left and right on-screen when rotated.
8. *Verify horizontal delay:*
   a. *Center a rising edge on screen:*
      - Set the horizontal **POSITION** knob so that the rising edge where the waveform is triggered is lined up with the center horizontal graticule.
      - Change the horizontal **SCALE** to **20 µs/div**. The rising edge of the waveform should remain near the center graticule and the falling edge should be off screen.
   b. *Turn on and set horizontal delay:*

- Pull down the **Horiz/Acq** menu to select **Horizontal/Acquisition Setup. . .** .
- Click the **Horizontal** tab in the control window that displays.
- Click the **Delay Mode** button to turn delay on.
- Double click the **Horiz Delay** control in the control window to display the pop-up keypad. Click the keypad buttons to set the horizontal delay to **1 ms** and then click the **ENTER** key.

c. *Verify the waveform:* Verify that a rising edge of the waveform is within a few divisions of center screen.

d. *Adjust the horizontal delay:* Rotate the upper multipurpose knob to change the horizontal delay setting. Verify that the rising edge shifts horizontally. Rotate the front-panel horizontal **POSITION** knob. Verify that this knob has the same effect (it also adjusts delay, but only when delay mode is on).

e. *Verify the delay toggle function:*

- Rotate the front-panel horizontal **POSITION** knob to center the falling edge horizontally on the screen.
- Change the horizontal **SCALE** to **40 ns/div**. The rising edge of the waveform should remain near the center graticule.
- Readjust the delay setting to position the rising edge 2 divisions to the right of the center graticule line.
- Push the front-panel **DELAY** button several times to toggle delay off and on and back off again. Verify that the display switches quickly between two different points in time (the rising edge shifts horizontally on the display).

9. *Remove the test hookup:* Disconnect the BNC cable from the channel input and the probe compensation output.

Verify the A (Main) and B (Delayed) Trigger Systems

Equipment required	One BNC cable, such as Tektronix part number 012-0076-00 One TCA-BNC adapter
Prerequisites	None

1. *Initialize the instrument:* Push the front-panel **DEFAULT SETUP** button.

2. *Hook up the signal source:* Connect the BNC cable from the probe compensation output to the CH 1 input through a TCA-BNC adapter as shown in Figure 4–5.

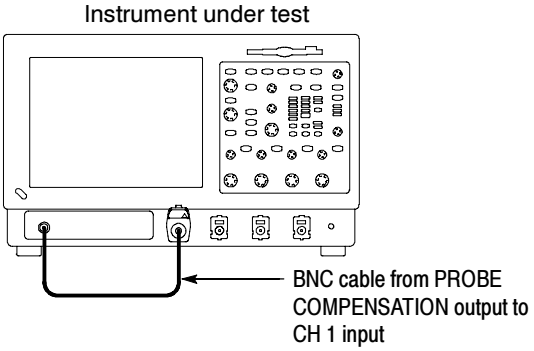

Figure 4- 5: Setup for trigger test

3. *Set up the instrument:* Push the front-panel **AUTOSET** button.
4. Pull down the **Vert** menu, select Vertical Setup, and then touch **Offset**. Adjust the Ch1 Offset to **-0.25 V** using the multipurpose knob.
5. Set the **Vertical SCALE** to **100 mV** per division.
6. *Verify that the main trigger system operates:* Confirm that the following statements are true.
   - The trigger level readout for the A (main) trigger system changes with the trigger-**LEVEL** knob.
   - The trigger-**LEVEL** knob can trigger and untrigger the square-wave signal as you rotate it. (Leave the signal *un*triggered).
   - Pushing the front-panel trigger **LEVEL** knob sets the trigger level to the 50% amplitude point of the signal and triggers the signal that you just left untriggered. (Leave the signal triggered.)
7. *Verify that the delayed trigger system operates:*
   a. *Set up the delayed trigger:*
      - Pull down the **Trig** menu and select **A — B Trigger Sequence. . .** . This displays the A→B Sequence tab of the trigger setup control window.
      - Click the **Trig After Time** button under A Then B.
      - Click the **B Trig Level** control in the control window.
      - Set the front-panel trigger mode to **NORM**.
   b. *Confirm that the following statements are tru*e:
      - The trigger-level readout for the B trigger system changes as you turn the lower multipurpose knob.

- As you rotate the lower multipurpose knob, the square-wave probe-compensation signal can become triggered and untriggered. (Leave the signal triggered.)

c. *Verify the delayed trigger counter:*

- Double click the **Trig Delay** control to pop up a numeric keypad for that control.
- Click the keypad to enter a trigger delay time of **1 second** and then click **Enter**.
- Verify that the trigger **READY** indicator on the front panel flashes about once every second as the waveform is updated on-screen.

8. *Remove the test hookup:* Disconnect the BNC cable from the channel input and the probe compensation output.

Verify the File System

Equipment required	One BNC cable, such as Tektronix part number 012-0076-00 One TCA-BNC adapter One 1.44 Mbyte, 3.5 inch DOS-compatible formatted disk.
Prerequisites	None

1. *Initialize the instrument:*Push the front-panel **DEFAULT SETUP** button.

2. *Hook up the signal source:* Connect the BNC cable from the probe compensation output to the CH 1 input through a TCA-BNC adapter as shown in Figure 4–6.

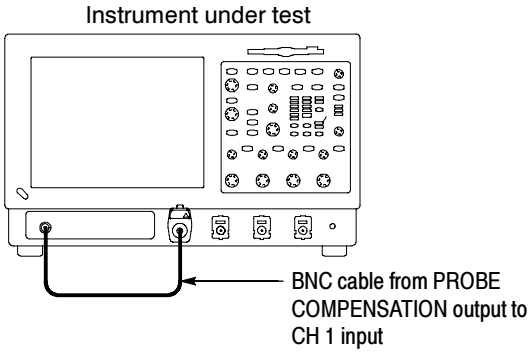

Figure 4- 6: Setup for the file system test

3. *Insert the test disk:* Insert the floppy disk in the floppy disk drive.

4. *Set up the instrument:* Push the front panel **AUTOSET** button.

5. Pull down the **Vert** menu, select **Vertical Setup**, and then touch **Offset**. Adjust the Ch1 Offset to **-0.25 V** using the multipurpose knob.

6. Set the **Vertical SCALE** to **100 mV** per division.

7. *Set the time base:* Set the horizontal **SCALE** to **1 ms/div**. The time-base readout is displayed at the bottom of the graticule.

8. *Save the settings:*

   a. Pull down the **File** menu to select **Instrument Setup. . .** . This displays the instrument setups control window.

   b. Click the **Save** button under Save settings to file in the control window. This displays a familiar Windows dialog box for choosing a destination folder naming the file.

   c. In the Save Instrument Setups As dialog box, select the **$3^1/_2$ Floppy (A:)** icon in the **Save in:** drop-down list to set the save destination to the floppy disk.

   d. Note the default file name and then click the **Save** button to save the setup to the default file name.

9. *Change the settings again:* Set the horizontal **SCALE** to **200 µs/div**.

10. *Verify the file system works:*

    a. Click the **Recall Setups** tab in the control window.

    b. Click the **Recall** button under Recall settings from file in the control window. This displays a familiar Windows dialog box for locating the settings file that you want to recall.

    c. In the Recall Instrument Setup dialog box, select the **$3^1/_2$ Floppy (A:)** icon in the **Look in:** drop-down list.

    d. Locate and then double click in the dialog box on the setup file that you previously stored.

    e. Verify that the instrument retrieved the saved setup from the disk. Do this by noticing the horizontal **SCALE** is again 1 ms and the waveform shows ten cycles just as it did when you saved the setup.

11. *Remove the test hookup:*

    a. Disconnect the BNC cable and adapter from the channel input and the probe compensation output.

    b. Remove the floppy disk from the floppy disk drive.

Performance Tests

This section contains a collection of manual procedures for checking that instrument performs as warranted.

The procedures are arranged in logical groupings: *Signal Acquisition System Checks, Time Base System Checks, Triggering System Checks*, *Output Ports Checks, Serial Trigger Checks, and Optical-to-Electrical Converter Checks*. They check all the characteristics that are designated as checked in *Specifications.* (The characteristics that are checked appear with a ✓ in *Specifications*).

STOP*. These procedures extend the confidence level provided by the basic procedures described on page 4–5. The basic procedures should be done first, then these procedures performed if desired.*

Prerequisites

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

- The cabinet must be installed on the instrument.
- You must have performed and passed the procedures under *Self Tests,* found on page 4–5, and those under *Functional Tests,* found on page 4–6.
- A signal-path compensation must have been done within the recommended calibration interval and at a temperature within ±5 °C of the present operating temperature. (If at the time you did the prerequisite *Self Tests,* the temperature was within the limits just stated, consider this prerequisite met). A signal-path compensation must have been done at an ambient humidity within 25% of the current ambient humidity and after having been at that humidity for at least 4 hours.
- The instrument must have been last adjusted at an ambient temperature between +20 °C and +30 °C, must have been operating for a warm-up period of at least 20 minutes, and must be operating at an ambient temperature as listed in Table 1–12. (The warm-up requirement is usually met in the course of meeting the Self Tests and Functional Tests prerequisites listed above).

Equipment Required

Procedures starting on page 4–45, use external, traceable signal sources to directly check warranted characteristics. Table 4–2 lists the required equipment.

Table 4-2: Test equipment

Item number and description	Minimum requirements	Example	Purpose
1. Attenuator,10X (two required)	Ratio: 10X; impedance 50 Ω; connectors: female input, male output	BNC ≤ 2 GHz Tektronix part number 011-0059-02 SMA ≤ 18 GHz Tektronix part number 015-1003-00	Signal attenuation
2. Attenuator, 5X	Ratio: 5X; impedance 50 Ω; connectors: female input, male output	BNC ≤ 2 GHz Tektronix part number 011-0060-02 SMA ≤ 18 GHz Tektronix part number 015-1002-01	Signal attenuation
3. Termination, 50 Ω (three required)	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0049-02	Signal termination for channel delay test
4. Cable, Precision 50 Ω Coaxial (three required)	50 Ω, 36 in, male-to-male BNC connectors	Tektronix part number 012-0482-00	Signal interconnection
5. Connector, Dual-Banana (two required)	Female BNC-to-dual banana	Tektronix part number 103-0090-00	Various accuracy tests
6. Connector, BNC "T"	Male BNC-to-dual female BNC	Tektronix part number 103-0030-00	Checking trigger sensitivity
7. Probe	A P7240 probe A P7260 probe (TDS7704B)	Tektronix part number P7240 Tektronix part number P7260 (TDS7704B)	Signal interconnection
8. Floppy disk	3.5 inch 1.44 Mbyte, DOS-compatible floppy disk	Standard IBM PC-compatible disk	Checking file system basic functionality
9. Generator, DC Calibration	Variable amplitude to ±7 V; accuracy to 0.1%	Fluke 9500B[1]	Checking DC offset, gain, measurement accuracy, and maximum input voltage
10. Generator, Calibration	500 mV square wave calibrator amplitude; accuracy to 0.25%	Fluke 9500B[1]	To check accuracy of signal out
11. Timer-counter	25 MHz, 1 s gate	Advantest R5360	Checking long-term sample rate and delay time accuracy

Table 4-2: Test equipment (Cont.)

Item number and description	Minimum requirements	Example	Purpose
12. Generator, Sine-Wave[3]	Instrument bandwidth ≤ 6 GHz: 5 kHz to at least the instrument bandwidth. Variable amplitude from 60 mV to 2 V_{p-p} into 50 Ω. Frequency error <2.0%	Rohde & Schwarz SMT06 with options 01 and 02	Checking analog bandwidth, trigger sensitivity, sample-rate, external clock, and delay-time accuracy
	Instrument bandwidth > 6 GHz: 10 MHz to at least the instrument bandwidth. Variable amplitude from 60 mV to 1.8 V_{p-p} into 50 Ω. Frequency error <2.0%	Anritsu MG3692A Synthesized CW Generator with options 2x, 4, and 15	
13. Meter, Level and Power Sensor	Frequency range: 10 MHz to the instrument bandwidth. Amplitude range: 6 mV_{p-p} to 2 V_{p-p}	Rohde & Schwarz NRVS and NRV-Z102	Checking analog bandwidth and Trigger Sensitivity
14. Splitter, Power	Frequency range: DC to 4 GHz. Tracking: >2.0%	Tektronix part number 015-0565-00	Checking delay between channels
15. Adapter (four required)	Male N-to-female BNC	Tektronix part number 103-0045-00	Checking analog bandwidth
16. Adapter	Female N-to-male BNC	Tektronix part number 103-0058-00	Checking analog bandwidth
17. Adapter (three required)	SMA female-to-female	Tektronix part number 015-1012-00	Checking the delay between channels
18. Adapter (three required)	SMA male-to-female BNC	Tektronix part number 015-1018-00	Checking the delay between channels
19. Adapter (four required)	SMA male-to-BNC female	TCA-BNC or TCA-SMA and SMA male-to-BNC female adapter (Tektronix part number 015-0554-00 or 015-1018-00)	Signal interconnection
20. Pulse Generator	2 MHz, ≤ 150 ps rise time, 5 V out	Fluke 9500B[1,2]	Used to test delta time measurement accuracy
21. Cable, Coaxial (two required)	50 Ω, 20 in, male-to-male SMA connectors	Tektronix part number 174-1427-00	Used to test delta time measurement accuracy
22. Adapter	SMA "T", male to 2 SMA female	Tektronix part number 015-1016-00	Used to test delta time measurement accuracy
23. Adapter	SMA female to BNC male	Tektronix part number 015-0572-00	Used to test delta time measurement accuracy
24. Adapter	BNC male to female elbow	Tektronix part number 103-0031-00	Used to test delta time measurement accuracy
25. Termination (two required)	Short circuit, SMA connector, female	Tektronix part number 015-1021-00	Used to test delta time measurement accuracy

Table 4-2: Test equipment (Cont.)

Item number and description	Minimum requirements	Example	Purpose
26. Attenuator, 2X	Ratio: 2X; impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0069-02	Used to test delta time measurement accuracy and pulse trigger accuracy
27. Digital Multimeter	Ohms: <60 Ohms	Keithley 2000	Checking input impedance
28. Optical Impulser	1550 nm impulse	IMRA Femtolite B-4-FC Optical Impulser	Optical Tests
29. CW laser source	780 nm, 850 nm, 1310 nm, and 1550 nm	JDS Uniphase 420B laser transmitter and Rifocs 716R with 702RT8.5 controller	Optical tests
30. Optical attenuator, variable	Multimode input and output, 0 to 60 dB	Tektronix OA5022 Optical Attenuator	Optical tests
31. Optical power meter	780 nm, 850 nm, 1310 nm, and 1550 nm	Agilent 8163A with 81618A optical head interface, 81625B InGaAs optical head and 81000FA FC/PC/SPC/APC connector adapter	Optical tests
32. Adapter	O/E electrical out to CH1 input	Tektronix part number 013-0327-00	Used to test O/E converter
33. Adapter	O/E electrical out to SMA	Tektronix part number 013-0326-00	Used to test O/E converter
34. Cable, fiber-optic (two required)	multimode, 2 m, FC/PC to FC/PC	Tektronix part number 174-2322-00	Tektronix part number 174-1910-00
35. Attenuator, optical	30mm, 10 dB, FC to FC, female to male	Tektronix part number 119-5118-00	Tektronix part number 119-5118-00
36. Cable, coaxial	50 Ω, 39.37 in (1.0m), male-to-male SMA connectors 50 Ω, 60 in (1.5m), male-to-male SMA connectors	Tektronix part number 174-1341-00 Tektronix part number 174-1428-00	Checking analog bandwidth
37. Termination	50 Ω, coaxial termination, K male	Anritsu-Wiltron 28K50	Anritsu-Wiltron 28K50
38. Dust cap	No light transmission	Dust cap provided with optical input	Dark level calibration and optical noise check
39. Probe calibration and deskew fixture	Standard accessory	Tektronix part number 067-0405-xx (067-0848-xx for TDS7704B)	Functional tests

1 Fluke 9500B/1100, 9500B/3200, or 9500B/2200 and an output head (9510, 9530, or 9560) appropriate for the bandwidth of the instrument being tested.

2 For Delta Time Measurement Accuracy, use a Fluke 9500B or a pulse generator with a rise time as shown in Table 4-9 on page 4-98.

3 On Instruments with a bandwidth ≤3 GHz, items 12, 13, and 14 may be replaced with a Fluke 9500B and an appropriate output head.

CSA7000B & TDS7000B Test Record

Photocopy this table and use it to record the performance test results for your instrument.

CSA7000B & TDS7000B Test Record

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
DC voltage measurement accuracy (averaged), **CSA7404B, TDS7404B, TDS7254B, & TDS7154B**					
CH1	2 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 512.79 mV	_____	_____	+ 519.21 mV
CH1	2 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 519.21 mV	_____	_____	- 512.79 mV
CH1	50 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 881.63 mV	_____	_____	+ 918.38 mV
CH1	50 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 918.38 V	_____	_____	- 881.63 mV
CH1	100 mV Vert scale setting, -5 Div position setting, +4.8 V offset	+ 4.9393 V	_____	_____	+ 5.0607 V
CH1	100 mV Vert scale setting, +5 Div position setting, -4.8 V offset	- 5.0607 V	_____	_____	- 4.9393 V
CH1	1.0 V Vert scale setting, -5 Div position setting, +2.5 V offset	+ 4.1738 V	_____	_____	+ 4.8263 V
CH1	1.0 V Vert scale setting, +5 Div position setting, -2.5 V offset	- 4.8263 V	_____	_____	- 4.1738 V
CH2	2 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 512.79 mV	_____	_____	+ 519.21 mV
CH2	2 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 519.21 mV	_____	_____	- 512.79 mV
CH2	50 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 881.63 mV	_____	_____	+ 918.38 mV
CH2	50 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 918.38 V	_____	_____	- 881.63 mV
CH2	100 mV Vert scale setting, -5 Div position setting, +4.8 V offset	+ 4.9393 V	_____	_____	+ 5.0607 V
CH2	100 mV Vert scale setting, +5 Div position setting, -4.8 V offset	- 5.0607 V	_____	_____	- 4.9393 V
CH2	1.0 V Vert scale setting, -5 Div position setting, +2.5 V offset	+ 4.1738 V	_____	_____	+ 4.8263 V
CH3	1.0 V Vert scale setting, +5 Div position setting, -2.5 V offset	- 4.8263 V	_____	_____	- 4.1738 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH3	2 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 512.79 mV	_____	_____	+ 519.21 mV
CH3	2 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 519.21 mV	_____	_____	- 512.79 mV
CH3	50 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 881.63 mV	_____	_____	+ 918.38 mV
CH3	50 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 918.38 V	_____	_____	- 881.63 mV
CH3	100 mV Vert scale setting, -5 Div position setting, +4.8 V offset	+ 4.9393 V	_____	_____	+ 5.0607 V
CH3	100 mV Vert scale setting, +5 Div position setting, -4.8 V offset	- 5.0607 V	_____	_____	- 4.9393 V
CH3	1.0 V Vert scale setting, -5 Div position setting, +2.5 V offset	+ 4.1738 V	_____	_____	+ 4.8263 V
CH3	1.0 V Vert scale setting, +5 Div position setting, -2.5 V offset	- 4.8263 V	_____	_____	- 4.1738 V
CH4	2 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 512.79 mV	_____	_____	+ 519.21 mV
CH4	2 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 519.21 mV	_____	_____	- 512.79 mV
CH4	50 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 881.63 mV	_____	_____	+ 918.38 mV
CH4	50 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 918.38 V	_____	_____	- 881.63 mV
CH4	100 mV Vert scale setting, -5 Div position setting, +4.8 V offset	+ 4.9393 V	_____	_____	+ 5.0607 V
CH4	100 mV Vert scale setting, +5 Div position setting, -4.8 V offset	- 5.0607 V	_____	_____	- 4.9393 V
CH4	1.0 V Vert scale setting, -5 Div position setting, +2.5 V offset	+ 4.1738 V	_____	_____	+ 4.8263 V
CH4	1.0 V Vert scale setting, +5 Div position setting, -2.5 V offset	- 4.8263 V	_____	_____	- 4.1738 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
DC voltage measurement accuracy (averaged), **TDS7704B**					
CH1	2 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 511.99 mV	_____	_____	+ 520.01 mV
CH1	2 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 520.01 mV	_____	_____	- 511.99 mV
CH1	50 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 879.75 mV	_____	_____	+ 920.25 mV
CH1	50 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 920.25 V	_____	_____	- 879.75 mV
CH1	100 mV Vert scale setting, -5 Div position setting, +4.8 V offset	+ 4.9298 V	_____	_____	+ 5.0702 V
CH1	100 mV Vert scale setting, +5 Div position setting, -4.8 V offset	- 5.0702 V	_____	_____	- 4.9298 V
CH1	1.0 V Vert scale setting, -5 Div position setting, +2.5 V offset	+ 4.1475 V	_____	_____	+ 4.8525 V
CH1	1.0 V Vert scale setting, +5 Div position setting, -2.5 V offset	- 4.8525 V	_____	_____	- 4.1475 V
CH2	2 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 511.99 mV	_____	_____	+ 520.01 mV
CH2	2 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 520.01 mV	_____	_____	- 511.99 mV
CH2	50 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 879.75 mV	_____	_____	+ 920.25 mV
CH2	50 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 920.25 V	_____	_____	- 879.75 mV
CH2	100 mV Vert scale setting, -5 Div position setting, +4.8 V offset	+ 4.9298 V	_____	_____	+ 5.0702 V
CH2	100 mV Vert scale setting, +5 Div position setting, -4.8 V offset	- 5.0702 V	_____	_____	- 4.9298 V
CH2	1.0 V Vert scale setting, -5 Div position setting, +2.5 V offset	+ 4.1475 V	_____	_____	+ 4.8525 V
CH2	1.0 V Vert scale setting, +5 Div position setting, -2.5 V offset	- 4.8525 V	_____	_____	- 4.1475 V
CH3	2 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 511.99 mV	_____	_____	+ 520.01 mV
CH3	2 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 520.01 mV	_____	_____	- 511.99 mV

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH3	50 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 879.75 mV	_____	_____	+ 920.25 mV
CH3	50 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 920.25 V	_____	_____	- 879.75 mV
CH3	100 mV Vert scale setting, -5 Div position setting, +4.8 V offset	+ 4.9298 V	_____	_____	+ 5.0702 V
CH3	100 mV Vert scale setting, +5 Div position setting, -4.8 V offset	- 5.0702 V	_____	_____	- 4.9298 V
CH3	1.0 V Vert scale setting, -5 Div position setting, +2.5 V offset	+ 4.1475 V	_____	_____	+ 4.8525 V
CH3	1.0 V Vert scale setting, +5 Div position setting, -2.5 V offset	- 4.8525 V	_____	_____	- 4.1475 V
CH4	2 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 511.99 mV	_____	_____	+ 520.01 mV
CH4	2 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 520.01 mV	_____	_____	- 511.99 mV
CH4	50 mV Vert scale setting, -5 Div position setting, +0.5 V offset	+ 879.75 mV	_____	_____	+ 920.25 mV
CH4	50 mV Vert scale setting, +5 Div position setting, -0.5 V offset	- 920.25 V	_____	_____	- 879.75 mV
CH4	100 mV Vert scale setting, -5 Div position setting, +4.8 V offset	+ 4.9298 V	_____	_____	+ 5.0702 V
CH4	100 mV Vert scale setting, +5 Div position setting, -4.8 V offset	- 5.0702 V	_____	_____	- 4.9298 V
CH4	1.0 V Vert scale setting, -5 Div position setting, +2.5 V offset	+ 4.1475 V	_____	_____	+ 4.8525 V
CH4	1.0 V Vert scale setting, +5 Div position setting, -2.5 V offset	- 4.8525 V	_____	_____	- 4.1475 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
DC gain accuracy (averaged), **CSA7404B, TDS7404B, TDS7254B, & TDS7154B**					
CH1	2 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 14.80 mV	_____	_____	+ 15.60 mV
	-5 Div position setting, +0.5 V offset	+ 14.40 mV	_____	_____	+ 16.00 mV
	+5 Div position setting, -0.5 V offset	+ 14.40 mV	_____	_____	+ 16.00 mV
CH1	5 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 37.24 mV	_____	_____	+ 38.76 mV
	-5 Div position setting, +0.5 V offset	+ 36.84 mV	_____	_____	+ 39.16 mV
	+5 Div position setting, -0.5 V offset	+ 36.84 mV	_____	_____	+ 39.16 mV
CH1	10 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 74.48 mV	_____	_____	+ 77.52 mV
	-5 Div position setting, +0.5 V offset	+ 73.64 mV	_____	_____	+ 78.36 mV
	+5 Div position setting, -0.5 V offset	+ 73.64 mV	_____	_____	+ 78.36 mV
CH1	20 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 149.0 mV	_____	_____	+ 155.0 mV
	-5 Div position setting, +0.5 V offset	+ 147.1 mV	_____	_____	+ 156.9 mV
	+5 Div position setting, -0.5 V offset	+ 147.1 mV	_____	_____	+ 156.9 mV
CH1	50 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 372.4 mV	_____	_____	+ 387.6 mV
	-5 Div position setting, +0.5 V offset	+ 366.7 mV	_____	_____	+ 393.3 mV
	+5 Div position setting, -0.5 V offset	+ 366.7 mV	_____	_____	+ 393.3 mV
CH1	100 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 744.8 mV	_____	_____	+ 775.2 mV
	0 Div position setting, +4.5 V offset	+ 738.0 mV	_____	_____	+ 782.0 mV
	0 Div position setting, -4.5 V offset	+ 738.0 mV	_____	_____	+ 782.0 mV
CH1	200 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 1.490 V	_____	_____	+ 1.550 V
	2 Div position setting, +4.6 V offset	+ 1.477 V	_____	_____	+ 1.563 V
	-2 Div position setting, -4.6 V offset	+ 1.477 V	_____	_____	+ 1.563 V
CH1	500 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 3.724 V	_____	_____	+ 3.876 V
	4 Div position setting, +5 V offset	+ 3.701 V	_____	_____	+ 3.899 V
	-4 Div position setting, -5 V offset	+ 3.701 V	_____	_____	+ 3.899 V
CH1	1.0 V Vert scale setting,				
	0 Div position setting, 0 V offset	+ 7.448 V	_____	_____	+ 7.752 V
	0 Div position setting, +2.0 V offset	+ 5.856 V	_____	_____	+ 6.144 V
	0 Div position setting, -2.0 V offset	- 5.856 V	_____	_____	- 6.144 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH2	2 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 14.80 mV	_____	_____	+ 15.60 mV
	-5 Div position setting, +0.5 V offset	+ 14.40 mV	_____	_____	+ 16.00 mV
	+5 Div position setting, -0.5 V offset	+ 14.40 mV	_____	_____	+ 16.00 mV
CH2	5 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 37.24 mV	_____	_____	+ 38.76 mV
	-5 Div position setting, +0.5 V offset	+ 36.84 mV	_____	_____	+ 39.16 mV
	+5 Div position setting, -0.5 V offset	+ 36.84 mV	_____	_____	+ 39.16 mV
CH2	10 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 74.48 mV	_____	_____	+ 77.52 mV
	-5 Div position setting, +0.5 V offset	+ 73.64 mV	_____	_____	+ 78.36 mV
	+5 Div position setting, -0.5 V offset	+ 73.64 mV	_____	_____	+ 78.36 mV
CH2	20 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 149.0 mV	_____	_____	+ 155.0 mV
	-5 Div position setting, +0.5 V offset	+ 147.1 mV	_____	_____	+ 156.9 mV
	+5 Div position setting, -0.5 V offset	+ 147.1 mV	_____	_____	+ 156.9 mV
CH2	50 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 372.4 mV	_____	_____	+ 387.6 mV
	-5 Div position setting, +0.5 V offset	+ 366.7 mV	_____	_____	+ 393.3 mV
	+5 Div position setting, -0.5 V offset	+ 366.7 mV	_____	_____	+ 393.3 mV
CH2	100 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 744.8 mV	_____	_____	+ 775.2 mV
	0 Div position setting, +4.5 V offset	+ 738.0 mV	_____	_____	+ 782.0 mV
	0 Div position setting, -4.5 V offset	+ 738.0 mV	_____	_____	+ 782.0 mV
CH2	200 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 1.490 V	_____	_____	+ 1.550 V
	2 Div position setting, +4.6 V offset	+ 1.477 V	_____	_____	+ 1.563 V
	-2 Div position setting, -4.6 V offset	+ 1.477 V	_____	_____	+ 1.563 V
CH2	500 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 3.724 V	_____	_____	+ 3.876 V
	4 Div position setting, +5 V offset	+ 3.701 V	_____	_____	+ 3.899 V
	-4 Div position setting, -5 V offset	+ 3.701 V	_____	_____	+ 3.899 V
CH2	1.0 V Vert scale setting,				
	0 Div position setting, 0 V offset	+ 7.448 V	_____	_____	+ 7.752 V
	0 Div position setting, +2.0 V offset	+ 5.856 V	_____	_____	+ 6.144 V
	0 Div position setting, -2.0 V offset	- 5.856 V	_____	_____	- 6.144 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH3	2 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 14.80 mV	_____	_____	+ 15.60 mV
	-5 Div position setting, +0.5 V offset	+ 14.40 mV	_____	_____	+ 16.00 mV
	+5 Div position setting, -0.5 V offset	+ 14.40 mV	_____	_____	+ 16.00 mV
CH3	5 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 37.24 mV	_____	_____	+ 38.76 mV
	-5 Div position setting, +0.5 V offset	+ 36.84 mV	_____	_____	+ 39.16 mV
	+5 Div position setting, -0.5 V offset	+ 36.84 mV	_____	_____	+ 39.16 mV
CH3	10 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 74.48 mV	_____	_____	+ 77.52 mV
	-5 Div position setting, +0.5 V offset	+ 73.64 mV	_____	_____	+ 78.36 mV
	+5 Div position setting, -0.5 V offset	+ 73.64 mV	_____	_____	+ 78.36 mV
CH3	20 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 149.0 mV	_____	_____	+ 155.0 mV
	-5 Div position setting, +0.5 V offset	+ 147.1 mV	_____	_____	+ 156.9 mV
	+5 Div position setting, -0.5 V offset	+ 147.1 mV	_____	_____	+ 156.9 mV
CH3	50 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 372.4 mV	_____	_____	+ 387.6 mV
	-5 Div position setting, +0.5 V offset	+ 366.7 mV	_____	_____	+ 393.3 mV
	+5 Div position setting, -0.5 V offset	+ 366.7 mV	_____	_____	+ 393.3 mV
CH3	100 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 744.8 mV	_____	_____	+ 775.2 mV
	0 Div position setting, +4.5 V offset	+ 738.0 mV	_____	_____	+ 782.0 mV
	0 Div position setting, -4.5 V offset	+ 738.0 mV	_____	_____	+ 782.0 mV
CH3	200 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 1.490 V	_____	_____	+ 1.550 V
	2 Div position setting, +4.6 V offset	+ 1.477 V	_____	_____	+ 1.563 V
	-2 Div position setting, -4.6 V offset	+ 1.477 V	_____	_____	+ 1.563 V
CH3	500 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 3.724 V	_____	_____	+ 3.876 V
	4 Div position setting, +5 V offset	+ 3.701 V	_____	_____	+ 3.899 V
	-4 Div position setting, -5 V offset	+ 3.701 V	_____	_____	+ 3.899 V
CH3	1.0 V Vert scale setting,				
	0 Div position setting, 0 V offset	+ 7.448 V	_____	_____	+ 7.752 V
	0 Div position setting, +2.0 V offset	+ 5.856 V	_____	_____	+ 6.144 V
	0 Div position setting, -2.0 V offset	- 5.856 V	_____	_____	- 6.144 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH4	2 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 14.80 mV	_____	_____	+ 15.60 mV
	-5 Div position setting, +0.5 V offset	+ 14.40 mV	_____	_____	+ 16.00 mV
	+5 Div position setting, -0.5 V offset	+ 14.40 mV	_____	_____	+ 16.00 mV
CH4	5 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 37.24 mV	_____	_____	+ 38.76 mV
	-5 Div position setting, +0.5 V offset	+ 36.84 mV	_____	_____	+ 39.16 mV
	+5 Div position setting, -0.5 V offset	+ 36.84 mV	_____	_____	+ 39.16 mV
CH4	10 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 74.48 mV	_____	_____	+ 77.52 mV
	-5 Div position setting, +0.5 V offset	+ 73.64 mV	_____	_____	+ 78.36 mV
	+5 Div position setting, -0.5 V offset	+ 73.64 mV	_____	_____	+ 78.36 mV
CH4	20 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 149.0 mV	_____	_____	+ 155.0 mV
	-5 Div position setting, +0.5 V offset	+ 147.1 mV	_____	_____	+ 156.9 mV
	+5 Div position setting, -0.5 V offset	+ 147.1 mV	_____	_____	+ 156.9 mV
CH4	50 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 372.4 mV	_____	_____	+ 387.6 mV
	-5 Div position setting, +0.5 V offset	+ 366.7 mV	_____	_____	+ 393.3 mV
	+5 Div position setting, -0.5 V offset	+ 366.7 mV	_____	_____	+ 393.3 mV
CH4	100 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 744.8 mV	_____	_____	+ 775.2 mV
	0 Div position setting, +4.5 V offset	+ 738.0 mV	_____	_____	+ 782.0 mV
	0 Div position setting, -4.5 V offset	+ 738.0 mV	_____	_____	+ 782.0 mV
CH4	200 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 1.490 V	_____	_____	+ 1.550 V
	2 Div position setting, +4.6 V offset	+ 1.477 V	_____	_____	+ 1.563 V
	-2 Div position setting, -4.6 V offset	+ 1.477 V	_____	_____	+ 1.563 V
CH4	500 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 3.724 V	_____	_____	+ 3.876 V
	4 Div position setting, +5 V offset	+ 3.701 V	_____	_____	+ 3.899 V
	-4 Div position setting, -5 V offset	+ 3.701 V	_____	_____	+ 3.899 V
CH4	1.0 V Vert scale setting,				
	0 Div position setting, 0 V offset	+ 7.448 V	_____	_____	+ 7.752 V
	0 Div position setting, +2.0 V offset	+ 5.856 V	_____	_____	+ 6.144 V
	0 Div position setting, -2.0 V offset	- 5.856 V	_____	_____	- 6.144 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
DC gain accuracy (averaged) **TDS7704B**					
CH1	2 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 14.74 mV	_____	_____	+ 15.66 mV
	-5 Div position setting, +0.5 V offset	+ 14.28 mV	_____	_____	+ 16.12 mV
	+5 Div position setting, -0.5 V offset	+ 14.28 mV	_____	_____	+ 16.12 mV
CH1	5 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 37.05 mV	_____	_____	+ 38.95 mV
	-5 Div position setting, +0.5 V offset	+ 36.65 mV	_____	_____	+ 39.35 mV
	+5 Div position setting, -0.5 V offset	+ 36.65 mV	_____	_____	+ 39.35 mV
CH1	10 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 74.10 mV	_____	_____	+ 77.90 mV
	-5 Div position setting, +0.5 V offset	+ 73.26 mV	_____	_____	+ 78.74 mV
	+5 Div position setting, -0.5 V offset	+ 73.26 mV	_____	_____	+ 78.74 mV
CH1	20 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 148.2 mV	_____	_____	+ 155.8 mV
	-5 Div position setting, +0.5 V offset	+ 146.4 mV	_____	_____	+ 157.6 mV
	+5 Div position setting, -0.5 V offset	+ 146.4 mV	_____	_____	+ 157.6 mV
CH1	50 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 370.5 mV	_____	_____	+ 389.5 mV
	-5 Div position setting, +0.5 V offset	+ 364.8 mV	_____	_____	+ 395.2 mV
	+5 Div position setting, -0.5 V offset	+ 364.8 mV	_____	_____	+ 395.2 mV
CH1	100 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 741.0 mV	_____	_____	+ 779.0 mV
	0 Div position setting, +4.5 V offset	+ 734.2 mV	_____	_____	+ 785.8 mV
	0 Div position setting, -4.5 V offset	+ 734.2 mV	_____	_____	+ 785.8 mV
CH1	200 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 1.482 V	_____	_____	+ 1.558 V
	2 Div position setting, +4.6 V offset	+ 1.469 V	_____	_____	+ 1.571 V
	-2 Div position setting, -4.6 V offset	+ 1.469 V	_____	_____	+ 1.571 V
CH1	500 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 3.705V	_____	_____	+ 3.895 V
	4 Div position setting, +5 V offset	+ 3.682 V	_____	_____	+ 3.918 V
	-4 Div position setting, -5 V offset	+ 3682 V	_____	_____	+ 3.918 V
CH1	1.0 V Vert scale setting,				
	0 Div position setting, 0 V offset	+ 7.410 V	_____	_____	+ 7.790 V
	0 Div position setting, +2.0 V offset	+ 5.826 V	_____	_____	+ 6.174 V
	0 Div position setting, -2.0 V offset	+ 5.826 V	_____	_____	+ 6.174 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH2	2 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 14.74 mV	_____	_____	+ 15.66 mV
	-5 Div position setting, +0.5 V offset	+ 14.28 mV	_____	_____	+ 16.12 mV
	+5 Div position setting, -0.5 V offset	+ 14.28 mV	_____	_____	+ 16.12 mV
CH2	5 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 37.05 mV	_____	_____	+ 38.95 mV
	-5 Div position setting, +0.5 V offset	+ 36.65 mV	_____	_____	+ 39.35 mV
	+5 Div position setting, -0.5 V offset	+ 36.65 mV	_____	_____	+ 39.35 mV
CH2	10 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 74.10 mV	_____	_____	+ 77.90 mV
	-5 Div position setting, +0.5 V offset	+ 73.26 mV	_____	_____	+ 78.74 mV
	+5 Div position setting, -0.5 V offset	+ 73.26 mV	_____	_____	+ 78.74 mV
CH2	20 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 148.2 mV	_____	_____	+ 155.8 mV
	-5 Div position setting, +0.5 V offset	+ 146.4 mV	_____	_____	+ 157.6 mV
	+5 Div position setting, -0.5 V offset	+ 146.4 mV	_____	_____	+ 157.6 mV
CH2	50 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 370.5 mV	_____	_____	+ 389.5 mV
	-5 Div position setting, +0.5 V offset	+ 364.8 mV	_____	_____	+ 395.2 mV
	+5 Div position setting, -0.5 V offset	+ 364.8 mV	_____	_____	+ 395.2 mV
CH2	100 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 741.0 mV	_____	_____	+ 779.0 mV
	0 Div position setting, +4.5 V offset	+ 734.2 mV	_____	_____	+ 785.8 mV
	0 Div position setting, -4.5 V offset	+ 734.2 mV	_____	_____	+ 785.8 mV
CH2	200 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 1.482 V	_____	_____	+ 1.558 V
	2 Div position setting, +4.6 V offset	+ 1.469 V	_____	_____	+ 1.571 V
	-2 Div position setting, -4.6 V offset	+ 1.469 V	_____	_____	+ 1.571 V
CH2	500 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 3.705V	_____	_____	+ 3.895 V
	4 Div position setting, +5 V offset	+ 3.682 V	_____	_____	+ 3.918 V
	-4 Div position setting, -5 V offset	+ 3682 V	_____	_____	+ 3.918 V
CH2	1.0 V Vert scale setting,				
	0 Div position setting, 0 V offset	+ 7.410 V	_____	_____	+ 7.790 V
	0 Div position setting, +2.0 V offset	+ 5.826 V	_____	_____	+ 6.174 V
	0 Div position setting, -2.0 V offset	+ 5.826 V	_____	_____	+ 6.174 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH3	2 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 14.74 mV	_____	_____	+ 15.66 mV
	-5 Div position setting, +0.5 V offset	+ 14.28 mV	_____	_____	+ 16.12 mV
	+5 Div position setting, -0.5 V offset	+ 14.28 mV	_____	_____	+ 16.12 mV
CH3	5 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 37.05 mV	_____	_____	+ 38.95 mV
	-5 Div position setting, +0.5 V offset	+ 36.65 mV	_____	_____	+ 39.35 mV
	+5 Div position setting, -0.5 V offset	+ 36.65 mV	_____	_____	+ 39.35 mV
CH3	10 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 74.10 mV	_____	_____	+ 77.90 mV
	-5 Div position setting, +0.5 V offset	+ 73.26 mV	_____	_____	+ 78.74 mV
	+5 Div position setting, -0.5 V offset	+ 73.26 mV	_____	_____	+ 78.74 mV
CH3	20 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 148.2 mV	_____	_____	+ 155.8 mV
	-5 Div position setting, +0.5 V offset	+ 146.4 mV	_____	_____	+ 157.6 mV
	+5 Div position setting, -0.5 V offset	+ 146.4 mV	_____	_____	+ 157.6 mV
CH3	50 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 370.5 mV	_____	_____	+ 389.5 mV
	-5 Div position setting, +0.5 V offset	+ 364.8 mV	_____	_____	+ 395.2 mV
	+5 Div position setting, -0.5 V offset	+ 364.8 mV	_____	_____	+ 395.2 mV
CH3	100 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 741.0 mV	_____	_____	+ 779.0 mV
	0 Div position setting, +4.5 V offset	+ 734.2 mV	_____	_____	+ 785.8 mV
	0 Div position setting, -4.5 V offset	+ 734.2 mV	_____	_____	+ 785.8 mV
CH3	200 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 1.482 V	_____	_____	+ 1.558 V
	2 Div position setting, +4.6 V offset	+ 1.469 V	_____	_____	+ 1.571 V
	-2 Div position setting, -4.6 V offset	+ 1.469 V	_____	_____	+ 1.571 V
CH3	500 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 3.705V	_____	_____	+ 3.895 V
	4 Div position setting, +5 V offset	+ 3.682 V	_____	_____	+ 3.918 V
	-4 Div position setting, -5 V offset	+ 3682 V	_____	_____	+ 3.918 V
CH3	1.0 V Vert scale setting,				
	0 Div position setting, 0 V offset	+ 7.410 V	_____	_____	+ 7.790 V
	0 Div position setting, +2.0 V offset	+ 5.826 V	_____	_____	+ 6.174 V
	0 Div position setting, -2.0 V offset	+ 5.826 V	_____	_____	+ 6.174 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH4	2 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 14.74 mV	_____	_____	+ 15.66 mV
	-5 Div position setting, +0.5 V offset	+ 14.28 mV	_____	_____	+ 16.12 mV
	+5 Div position setting, -0.5 V offset	+ 14.28 mV	_____	_____	+ 16.12 mV
CH4	5 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 37.05 mV	_____	_____	+ 38.95 mV
	-5 Div position setting, +0.5 V offset	+ 36.65 mV	_____	_____	+ 39.35 mV
	+5 Div position setting, -0.5 V offset	+ 36.65 mV	_____	_____	+ 39.35 mV
CH4	10 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 74.10 mV	_____	_____	+ 77.90 mV
	-5 Div position setting, +0.5 V offset	+ 73.26 mV	_____	_____	+ 78.74 mV
	+5 Div position setting, -0.5 V offset	+ 73.26 mV	_____	_____	+ 78.74 mV
CH4	20 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 148.2 mV	_____	_____	+ 155.8 mV
	-5 Div position setting, +0.5 V offset	+ 146.4 mV	_____	_____	+ 157.6 mV
	+5 Div position setting, -0.5 V offset	+ 146.4 mV	_____	_____	+ 157.6 mV
CH4	50 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 370.5 mV	_____	_____	+ 389.5 mV
	-5 Div position setting, +0.5 V offset	+ 364.8 mV	_____	_____	+ 395.2 mV
	+5 Div position setting, -0.5 V offset	+ 364.8 mV	_____	_____	+ 395.2 mV
CH4	100 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 741.0 mV	_____	_____	+ 779.0 mV
	0 Div position setting, +4.5 V offset	+ 734.2 mV	_____	_____	+ 785.8 mV
	0 Div position setting, -4.5 V offset	+ 734.2 mV	_____	_____	+ 785.8 mV
CH4	200 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 1.482 V	_____	_____	+ 1.558 V
	2 Div position setting, +4.6 V offset	+ 1.469 V	_____	_____	+ 1.571 V
	-2 Div position setting, -4.6 V offset	+ 1.469 V	_____	_____	+ 1.571 V
CH4	500 mV Vert scale setting,				
	0 Div position setting, 0 V offset	+ 3.705V	_____	_____	+ 3.895 V
	4 Div position setting, +5 V offset	+ 3.682 V	_____	_____	+ 3.918 V
	-4 Div position setting, -5 V offset	+ 3682 V	_____	_____	+ 3.918 V
CH4	1.0 V Vert scale setting,				
	0 Div position setting, 0 V offset	+ 7.410 V	_____	_____	+ 7.790 V
	0 Div position setting, +2.0 V offset	+ 5.826 V	_____	_____	+ 6.174 V
	0 Div position setting, -2.0 V offset	+ 5.826 V	_____	_____	+ 6.174 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
Offset accuracy, **CSA7404B, TDS7404B, TDS7254B, & TDS7154B**					
CH1	2 mV Vert scale setting,				
	0 Div position setting, +0.5 V offset	+ 497.3 mV	_____	_____	+ 502.7 mV
	0 Div position setting, 0 V offset	- 1.7 mV	_____	_____	+ 1.7 mV
	0 Div position setting, -0.5 V offset	- 502.7 mV	_____	_____	- 497.3 mV
CH1	50 mV Vert scale setting,				
	0 Div position setting, +0.5 V offset	+ 491.75 mV	_____	_____	+ 508.25 mV
	0 Div position setting, 0 V offset	- 6.5 mV	_____	_____	+ 6.5 mV
	0 Div position setting, -0.5 V offset	- 508.25 mV	_____	_____	- 491.75 mV
CH1	100 mV Vert scale setting,				
	0 Div position setting, +5 V offset	+ 4.9575 V	_____	_____	+ 5.0425 V
	0 Div position setting, 0 V offset	- 25 mV	_____	_____	+ 25 mV
	0 Div position setting, -5 V offset	- 5.0425 V	_____	_____	- 4.9575 V
CH1	500 mV Vert scale setting,				
	0 Div position setting, +5 V offset	+ 4.9175 V	_____	_____	+ 5.0825 V
	0 Div position setting, 0 V offset	- 65 mV	_____	_____	+ 65 mV
	0 Div position setting, -5 V offset	- 5.0825 V	_____	_____	- 4.9175 V
CH1	1.0 V Vert scale setting,				
	0 Div position setting, +2.5 V offset	+ 2.37625 V	_____	_____	+ 2.62375 V
	0 Div position setting, 0 V offset	- 115 mV	_____	_____	+ 115 mV
	0 Div position setting, -2.5 V offset	- 2.62375 V	_____	_____	- 2.37625 V
CH2	2 mV Vert scale setting,				
	0 Div position setting, +0.5 V offset	+ 497.3 mV	_____	_____	+ 502.7 mV
	0 Div position setting, 0 V offset	- 1.7 mV	_____	_____	+ 1.7 mV
	0 Div position setting, -0.5 V offset	- 502.7 mV	_____	_____	- 497.3 mV
CH2	50 mV Vert scale setting,				
	0 Div position setting, +0.5 V offset	+ 491.75 mV	_____	_____	+ 508.25 mV
	0 Div position setting, 0 V offset	- 6.5 mV	_____	_____	+ 6.5 mV
	0 Div position setting, -0.5 V offset	- 508.25 mV	_____	_____	- 491.75 mV
CH2	100 mV Vert scale setting,				
	0 Div position setting, +5 V offset	+ 4.9575 V	_____	_____	+ 5.0425 V
	0 Div position setting, 0 V offset	- 25 mV	_____	_____	+ 25 mV
	0 Div position setting, -5 V offset	- 5.0425 V	_____	_____	- 4.9575 V
CH2	500 mV Vert scale setting,				
	0 Div position setting, +5 V offset	+ 4.9175 V	_____	_____	+ 5.0825 V
	0 Div position setting, 0 V offset	- 65 mV	_____	_____	+ 65 mV
	0 Div position setting, -5 V offset	- 5.0825 V	_____	_____	- 4.9175 V
CH2	1.0 V Vert scale setting,				
	0 Div position setting, +2.5 V offset	+ 2.37625 V	_____	_____	+ 2.62375 V
	0 Div position setting, 0 V offset	- 115 mV	_____	_____	+ 115 mV
	0 Div position setting, -2.5 V offset	- 2.62375 V	_____	_____	- 2.37625 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH3	2 mV Vert scale setting,				
	0 Div position setting, +0.5 V offset	+ 497.3 mV	_____	_____	+ 502.7 mV
	0 Div position setting, 0 V offset	- 1.7 mV	_____	_____	+ 1.7 mV
	0 Div position setting, -0.5 V offset	- 502.7 mV	_____	_____	- 497.3 mV
CH3	50 mV Vert scale setting,				
	0 Div position setting, +0.5 V offset	+ 491.75 mV	_____	_____	+ 508.25 mV
	0 Div position setting, 0 V offset	- 6.5 mV	_____	_____	+ 6.5 mV
	0 Div position setting, -0.5 V offset	- 508.25 mV	_____	_____	- 491.75 mV
CH3	100 mV Vert scale setting,				
	0 Div position setting, +5 V offset	+ 4.9575 V	_____	_____	+ 5.0425 V
	0 Div position setting, 0 V offset	- 25 mV	_____	_____	+ 25 mV
	0 Div position setting, -5 V offset	- 5.0425 V	_____	_____	- 4.9575 V
CH3	500 mV Vert scale setting,				
	0 Div position setting, +5 V offset	+ 4.9175 V	_____	_____	+ 5.0825 V
	0 Div position setting, 0 V offset	- 65 mV	_____	_____	+ 65 mV
	0 Div position setting, -5 V offset	- 5.0825 V	_____	_____	- 4.9175 V
CH3	1.0 V Vert scale setting,				
	0 Div position setting, +2.5 V offset	+ 2.37625 V	_____	_____	+ 2.62375 V
	0 Div position setting, 0 V offset	- 115 mV	_____	_____	+ 115 mV
	0 Div position setting, -2.5 V offset	- 2.62375 V	_____	_____	- 2.37625 V
CH4	2 mV Vert scale setting,				
	0 Div position setting, +0.5 V offset	+ 497.3 mV	_____	_____	+ 502.7 mV
	0 Div position setting, 0 V offset	- 1.7 mV	_____	_____	+ 1.7 mV
	0 Div position setting, -0.5 V offset	- 502.7 mV	_____	_____	- 497.3 mV
CH4	50 mV Vert scale setting,				
	0 Div position setting, +0.5 V offset	+ 491.75 mV	_____	_____	+ 508.25 mV
	0 Div position setting, 0 V offset	- 6.5 mV	_____	_____	+ 6.5 mV
	0 Div position setting, -0.5 V offset	- 508.25 mV	_____	_____	- 491.75 mV
CH4	100 mV Vert scale setting,				
	0 Div position setting, +5 V offset	+ 4.9575 V	_____	_____	+ 5.0425 V
	0 Div position setting, 0 V offset	- 25 mV	_____	_____	+ 25 mV
	0 Div position setting, -5 V offset	- 5.0425 V	_____	_____	- 4.9575 V
CH4	500 mV Vert scale setting,				
	0 Div position setting, +5 V offset	+ 4.9175 V	_____	_____	+ 5.0825 V
	0 Div position setting, 0 V offset	- 65 mV	_____	_____	+ 65 mV
	0 Div position setting, -5 V offset	- 5.0825 V	_____	_____	- 4.9175 V
CH4	1.0 V Vert scale setting,				
	0 Div position setting, +2.5 V offset	+ 2.37625 V	_____	_____	+ 2.62375 V
	0 Div position setting, 0 V offset	- 115 mV	_____	_____	+ 115 mV
	0 Div position setting, -2.5 V offset	- 2.62375 V	_____	_____	- 2.37625 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
Offset accuracy, **TDS7704B**					
CH1	2 mV Vert scale setting, +0.5 V offset 0 V offset -0.5 V offset	 + 496.55 mV - 1.7 mV - 503.45 mV	 _____ _____ _____	 _____ _____ _____	 + 503.45 mV + 1.7 mV - 496.55 mV
CH1	50 mV Vert scale setting, +0.5 V offset 0 V offset -0.5 V offset	 + 491.00 mV - 6.5 mV - 509.00 mV	 _____ _____ _____	 _____ _____ _____	 + 509.00 mV + 6.5 mV - 491.00 mV
CH1	100 mV Vert scale setting, +5 V offset 0 V offset -5 V offset	 + 4.95 V - 25 mV - 5.05 V	 _____ _____ _____	 _____ _____ _____	 + 5.05 V + 25 mV - 4.95 V
CH1	500 mV Vert scale setting, +5 V offset 0 V offset -5 V offset	 + 4.91 V - 65 mV - 5.09 V	 _____ _____ _____	 _____ _____ _____	 + 5.09 V + 65 mV - 4.91 V
CH1	1.0 V Vert scale setting, +2.5 V offset 0 V offset -2.5 V offset	 + 2.3725 V - 115 mV - 2.6275 V	 _____ _____ _____	 _____ _____ _____	 + 2.6275 V + 115 mV - 2.3725 V
CH2	2 mV Vert scale setting, +0.5 V offset 0 V offset -0.5 V offset	 + 496.55 mV - 1.7 mV - 503.45 mV	 _____ _____ _____	 _____ _____ _____	 + 503.45 mV + 1.7 mV - 496.55 mV
CH2	50 mV Vert scale setting, +0.5 V offset 0 V offset -0.5 V offset	 + 491.00 mV - 6.5 mV - 509.00 mV	 _____ _____ _____	 _____ _____ _____	 + 509.00 mV + 6.5 mV - 491.00 mV
CH2	100 mV Vert scale setting, +5 V offset 0 V offset -5 V offset	 + 4.95 V - 25 mV - 5.05 V	 _____ _____ _____	 _____ _____ _____	 + 5.05 V + 25 mV - 4.95 V
CH2	500 mV Vert scale setting, +5 V offset 0 V offset -5 V offset	 + 4.91 V - 65 mV - 5.068 V	 _____ _____ _____	 _____ _____ _____	 + 5.068 V + 65 mV - 4.91 V
CH2	1.0 V Vert scale setting, +2.5 V offset 0 V offset -2.5 V offset	 + 2.3725 V - 115 mV - 2.6275 V	 _____ _____ _____	 _____ _____ _____	 + 2.6275 V + 115 mV - 2.3725 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH3	2 mV Vert scale setting,				
	+0.5 V offset	+ 496.55 mV	_____	_____	+ 503.45 mV
	0 V offset	- 1.7 mV	_____	_____	+ 1.7 mV
	-0.5 V offset	- 503.45 mV	_____	_____	- 496.55 mV
CH3	50 mV Vert scale setting,				
	+0.5 V offset	+ 491.00 mV	_____	_____	+ 509.00 mV
	0 V offset	- 6.5 mV	_____	_____	+ 6.5 mV
	-0.5 V offset	- 509.00 mV	_____	_____	- 491.00 mV
CH3	100 mV Vert scale setting,				
	+5 V offset	+ 4.95 V	_____	_____	+ 5.05 V
	0 V offset	- 25 mV	_____	_____	+ 25 mV
	-5 V offset	- 5.05 V	_____	_____	- 4.95 V
CH3	500 mV Vert scale setting,				
	+5 V offset	+ 4.91 V	_____	_____	+ 5.09 V
	0 V offset	- 65 mV	_____	_____	+ 65 mV
	-5 V offset	- 5.09 V	_____	_____	- 4.91 V
CH3	1.0 V Vert scale setting,				
	+2.5 V offset	+ 2.3725 V	_____	_____	+ 2.6275 V
	0 V offset	- 115 mV	_____	_____	+ 115 mV
	-2.5 V offset	- 2.6275 V	_____	_____	- 2.3725 V
CH4	2 mV Vert scale setting,				
	+0.5 V offset	+ 496.55 mV	_____	_____	+ 503.45 mV
	0 V offset	- 1.7 mV	_____	_____	+ 1.7 mV
	-0.5 V offset	- 503.45 mV	_____	_____	- 496.55 mV
CH4	50 mV Vert scale setting,				
	+0.5 V offset	+ 491.00 mV	_____	_____	+ 509.00 mV
	0 V offset	- 6.5 mV	_____	_____	+ 6.5 mV
	-0.5 V offset	- 509.00 mV	_____	_____	- 491.00 mV
CH4	100 mV Vert scale setting,				
	+5 V offset	+ 4.95 V	_____	_____	+ 5.05 V
	0 V offset	- 25 mV	_____	_____	+ 25 mV
	-5 V offset	- 5.05 V	_____	_____	- 4.95 V
CH4	500 mV Vert scale setting,				
	+5 V offset	+ 4.91 V	_____	_____	+ 5.09 V
	0 V offset	- 65 mV	_____	_____	+ 65 mV
	-5 V offset	- 5.09 V	_____	_____	- 4.91 V
CH4	1.0 V Vert scale setting,				
	+2.5 V offset	+ 2.3725 V	_____	_____	+ 2.6275 V
	0 V offset	- 115 mV	_____	_____	+ 115 mV
	-2.5 V offset	- 2.6275 V	_____	_____	- 2.3725 V

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test	Minimum	Incoming	Outgoing	Maximum
Maximum input voltage, **CSA7404B, TDS7404B, TDS7254B, & TDS7154B**				
CH1 50 mV Vert scale setting,				
+1 V input	Pass	_____	_____	N/A
+3 V input	Pass	_____	_____	N/A
CH1 1 V Vert scale setting,				
+5 V input	Pass	_____	_____	N/A
+10 V input	Pass	_____	_____	N/A
CH2 50 mV Vert scale setting,				
+1 V input	Pass	_____	_____	N/A
+3 V input	Pass	_____	_____	N/A
CH2 1 V Vert scale setting,				
+5 V input	Pass	_____	_____	N/A
+10 V input	Pass	_____	_____	N/A
CH3 50 mV Vert scale setting,				
+1 V input	Pass	_____	_____	N/A
+3 V input	Pass	_____	_____	N/A
CH3 1 V Vert scale setting,				
+5 V input	Pass	_____	_____	N/A
+10 V input	Pass	_____	_____	N/A
CH4 50 mV Vert scale setting,				
+1 V input	Pass	_____	_____	N/A
+3 V input	Pass	_____	_____	N/A
CH4 1 V Vert scale setting,				
+5 V input	Pass	_____	_____	N/A
+10 V input	Pass	_____	_____	N/A
Maximum input voltage, **TDS7704B**				
CH1 50 mV Vert scale setting,				
+1 V input	Pass	_____	_____	N/A
+3 V input	Pass	_____	_____	N/A
CH1 1 V Vert scale setting,				
+6.5 V input	Pass	_____	_____	N/A
+10 V input	Pass	_____	_____	N/A
CH2 50 mV Vert scale setting,				
+1 V input	Pass	_____	_____	N/A
+3 V input	Pass	_____	_____	N/A
CH2 1 V Vert scale setting,				
+6.5 V input	Pass	_____	_____	N/A
+10 V input	Pass	_____	_____	N/A

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
CH3	50 mV Vert scale setting,				
	+1 V input	Pass	_____	_____	N/A
	+3 V input	Pass	_____	_____	N/A
CH3	1 V Vert scale setting,				
	+6.5 V input	Pass	_____	_____	N/A
	+10 V input	Pass	_____	_____	N/A
CH4	50 mV Vert scale setting,				
	+1 V input	Pass	_____	_____	N/A
	+3 V input	Pass	_____	_____	N/A
CH4	1 V Vert scale setting,				
	+6.5 V input	Pass	_____	_____	N/A
	+10 V input	Pass	_____	_____	N/A
Analog bandwidth					
CH1	1 V	3.535 V	_____	_____	N/A
	500 mV	2.12 V	_____	_____	N/A
	200 mV	848 mV	_____	_____	N/A
	100 mV	424 mV	_____	_____	N/A
	50 mV	212 mV	_____	_____	N/A
	20 mV	84.8 mV	_____	_____	N/A
	10 mV	42.4 mV	_____	_____	N/A
	5 mV	21.2 mV	_____	_____	N/A
	2 mV	8.48 mV	_____	_____	N/A
CH2	1 V	3.535 V	_____	_____	N/A
	500 mV	2.12 V	_____	_____	N/A
	200 mV	848 V	_____	_____	N/A
	100 mV	424 mV	_____	_____	N/A
	50 mV	212 mV	_____	_____	N/A
	20 mV	84.8 mV	_____	_____	N/A
	10 mV	42.4 mV	_____	_____	N/A
	5 mV	21.2 mV	_____	_____	N/A
	2 mV	8.48 mV	_____	_____	N/A
CH3	1 V	3.535 V	_____	_____	N/A
	500 mV	2.12 V	_____	_____	N/A
	200 mV	848 V	_____	_____	N/A
	100 mV	424 mV	_____	_____	N/A
	50 mV	212 mV	_____	_____	N/A
	20 mV	84.8 mV	_____	_____	N/A
	10 mV	42.4 mV	_____	_____	N/A
	5 mV	21.2 mV	_____	_____	N/A
	2 mV	8.48 mV	_____	_____	N/A

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test			Minimum	Incoming	Outgoing	Maximum
CH4	1 V		3.535 V	_____	_____	N/A
	500 mV		2.12 V	_____	_____	N/A
	200 mV		848 V	_____	_____	N/A
	100 mV		424 mV	_____	_____	N/A
	50 mV		212 mV	_____	_____	N/A
	20 mV		84.8 mV	_____	_____	N/A
	10 mV		42.4 mV	_____	_____	N/A
	5 mW		21.2 mV	_____	_____	N/A
	2 mV		8.48 mV	_____	_____	N/A
Delay between channels			N/A	_____	_____	±30 ps
Channel isolation	1.5 GHz					
		100 mV				
		CH 1	N/A	_____	_____	0.125 divisions
		CH 2	N/A	_____	_____	0.125 divisions
		CH 3	N/A	_____	_____	0.125 divisions
		CH 4	N/A	_____	_____	0.125 divisions
		50 mV				
		CH 1	N/A	_____	_____	0.125 divisions
		CH 2	N/A	_____	_____	0.125 divisions
		CH 3	N/A	_____	_____	0.125 divisions
		CH 4	N/A	_____	_____	0.125 divisions
		10 mV				
		CH 1	N/A	_____	_____	0.125 divisions
		CH 2	N/A	_____	_____	0.125 divisions
		CH 3	N/A	_____	_____	0.125 divisions
		CH 4	N/A	_____	_____	0.125 divisions
	full bandwidth					
		100 mV				
		CH 1	N/A	_____	_____	0.67 divisions
		CH 2	N/A	_____	_____	0.67 divisions
		CH 3	N/A	_____	_____	0.67 divisions
		CH 4	N/A	_____	_____	0.67 divisions
		50 mV				
		CH 1	N/A	_____	_____	0.67 divisions
		CH 2	N/A	_____	_____	0.67 divisions
		CH 3	N/A	_____	_____	0.67 divisions
		CH 4	N/A	_____	_____	0.67 divisions
		10 mV				
		CH 1	N/A	_____	_____	0.67 divisions
		CH 2	N/A	_____	_____	0.67 divisions
		CH 3	N/A	_____	_____	0.67 divisions
		CH 4	N/A	_____	_____	0.67 divisions

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test	Minimum	Incoming	Outgoing	Maximum
Input impedance				
CH1 10 mV	48.75 Ω	_____	_____	51.25 Ω
CH1 100 mV	48.75 Ω	_____	_____	51.25 Ω
CH2 10 mV	48.75 Ω	_____	_____	51.25 Ω
CH2 100 mV	48.75 Ω	_____	_____	51.25 Ω
CH3 10 mV	48.75 Ω	_____	_____	51.25 Ω
CH3 100 mV	48.75 Ω	_____	_____	51.25 Ω
CH4 10 mV	48.75 Ω	_____	_____	51.25 Ω
CH4 100 mV	48.75 Ω	_____	_____	51.25 Ω
Time base system				
Long term sample rate, delay time, and internal reference accuracy	9999.975 kHz	_____	_____	10000.025 kHz
Delta time measurement	N/A	_____	_____	≤ 0.015 ns
Trigger system accuracy				
Time accuracy for pulse, glitch, timeout, and width, Hor. scale 1 ns < time < 1 μs				
Lower Limit	4.75 ns	_____	_____	5.25 ns
Upper Limit	4.75 ns	_____	_____	5.25 ns
Probe compensation output signal				
Frequency	950 Hz	_____	_____	1.050 kHz
Voltage (difference)	400 mV	_____	_____	600 mV
Serial trigger (Option ST only)				

CSA7000B & TDS7000B Test Record (cont.)

Baud rate limits				
Serial word recognizer				
Signal path 0, Pattern matching 1		_____	_____	
Trigger 1 UI before 0	Pass	_____	_____	N/A
Trigger on 0	Pass	_____	_____	N/A
Trigger 1 UI after 0	Pass	_____	_____	N/A
Signal path 1, Pattern matching 1		_____	_____	
Trigger 1 UI before 1	Pass	_____	_____	N/A
Trigger on 1	Pass	_____	_____	N/A
Trigger 1 UI after 1	Pass	_____	_____	N/A
Pattern matching 0		_____	_____	
Position 1	Pass	_____	_____	N/A
Position 2	Pass	_____	_____	N/A
Position 3	Pass	_____	_____	N/A
Position 4	Pass	_____	_____	N/A
Position 5	Pass	_____	_____	N/A
Position 6	Pass	_____	_____	N/A
Position 7	Pass	_____	_____	N/A
Position 8	Pass	_____	_____	N/A
Position 9	Pass	_____	_____	N/A
Position 10	Pass	_____	_____	N/A
Position 11	Pass	_____	_____	N/A
Position 12	Pass	_____	_____	N/A
Position 13	Pass	_____	_____	N/A
Position 14	Pass	_____	_____	N/A
Position 15	Pass	_____	_____	N/A
Position 16	Pass	_____	_____	N/A
Position 17	Pass	_____	_____	N/A
Position 18	Pass	_____	_____	N/A
Position 19	Pass	_____	_____	N/A
Position 20	Pass	_____	_____	N/A
Position 21	Pass	_____	_____	N/A
Position 22	Pass	_____	_____	N/A
Position 23	Pass	_____	_____	N/A
Position 24	Pass	_____	_____	N/A
Position 25	Pass	_____	_____	N/A
Position 26	Pass	_____	_____	N/A
Position 27	Pass	_____	_____	N/A
Position 28	Pass	_____	_____	N/A
Position 29	Pass	_____	_____	N/A
Position 30	Pass	_____	_____	N/A
Position 31	Pass	_____	_____	N/A
Position 32	Pass	_____	_____	N/A
Position 33	Pass	_____	_____	N/A
Position 34	Pass	_____	_____	N/A
Position 35	Pass	_____	_____	N/A
Position 36	Pass	_____	_____	N/A
Position 37	Pass	_____	_____	N/A
Position 38	Pass	_____	_____	N/A
Position 39	Pass	_____	_____	N/A

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test	Minimum	Incoming	Outgoing	Maximum
Pattern matching 0 (continued)				
Position 40	Pass	_____	_____	N/A
Position 41	Pass	_____	_____	N/A
Position 42	Pass	_____	_____	N/A
Position 43	Pass	_____	_____	N/A
Position 44	Pass	_____	_____	N/A
Position 45	Pass	_____	_____	N/A
Position 46	Pass	_____	_____	N/A
Position 47	Pass	_____	_____	N/A
Position 48	Pass	_____	_____	N/A
Position 49	Pass	_____	_____	N/A
Position 50	Pass	_____	_____	N/A
Position 51	Pass	_____	_____	N/A
Position 52	Pass	_____	_____	N/A
Position 53	Pass	_____	_____	N/A
Position 54	Pass	_____	_____	N/A
Position 55	Pass	_____	_____	N/A
Position 56	Pass	_____	_____	N/A
Position 57	Pass	_____	_____	N/A
Position 58	Pass	_____	_____	N/A
Position 59	Pass	_____	_____	N/A
Position 60	Pass	_____	_____	N/A
Position 61	Pass	_____	_____	N/A
Position 62	Pass	_____	_____	N/A
Position 63	Pass	_____	_____	N/A
Position 64	Pass	_____	_____	N/A
Clock recovery frequency range	Pass	_____	_____	N/A

CSA7000B & TDS7000B Test Record (cont.)

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

Instrument performance test	Minimum	Incoming	Outgoing	Maximum
Optical-to-electrical converter (CSA7000B Series only)				
Dark level,				
10 μW	N/A	_____	_____	2.6 μW
20 μW	N/A	_____	_____	3.6 μW
50 μW	N/A	_____	_____	6.6 μW
O/E noise output, maximum				
CSA7404B				
1550 and 1310 nm	N/A	_____	_____	4.35 μW
850 nm	N/A	_____	_____	5.35 μW
750 nm	N/A	_____	_____	5.85 μW
O/E gain				
780 nm	27 mV	_____	_____	N/A
850 nm	33 mV	_____	_____	N/A
1310 nm	64 mV	_____	_____	N/A
1550 nm	64 mV	_____	_____	N/A
System bandwidth (O/E, O/E-to-CH1 input adaptor, Communications Signal Analyzer)				
CSA7404B				
2.4 GHz	2.4 GHz	_____	_____	N/A

Signal Acquisition System Checks

These procedures check those characteristics that relate to the signal-acquisition system and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 4–2 on page 4–18 for test equipment specifications.

Check DC Voltage Measurement Accuracy

Equipment required	Two dual-banana connectors (Item 5) One BNC T connector (Item 6) One DC calibration generator (Item 9) One SMA male-to-female BNC adapter (Item 19) Two precision 50 Ω coaxial cables (Item 4)
Prerequisites	The instrument must meet the prerequisites listed on page 4–17

WARNING. *The generator is capable of outputting dangerous voltages. Be sure to set the DC calibration generator to off or 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure. Also, check that the calibrator does not have shorting straps installed between the DC output, sense input, or grounds.*

1. *Install the test hookup and preset the instrument controls:*

   a. *Hook up the test-signal source:*

   - Set the output of a DC calibration generator to off or 0 volts.
   - Connect the output of a DC calibration generator through a dual-banana connector followed by a 50 Ω precision coaxial cable to one side of a BNC T connector. See Figure 4–7.
   - Connect the Sense input of the generator through a second dual-banana connector followed by a 50 Ω precision coaxial cable to the other side of the BNC T connector. Now connect the BNC T connector to **CH 1** through an adapter. See Figure 4–7.

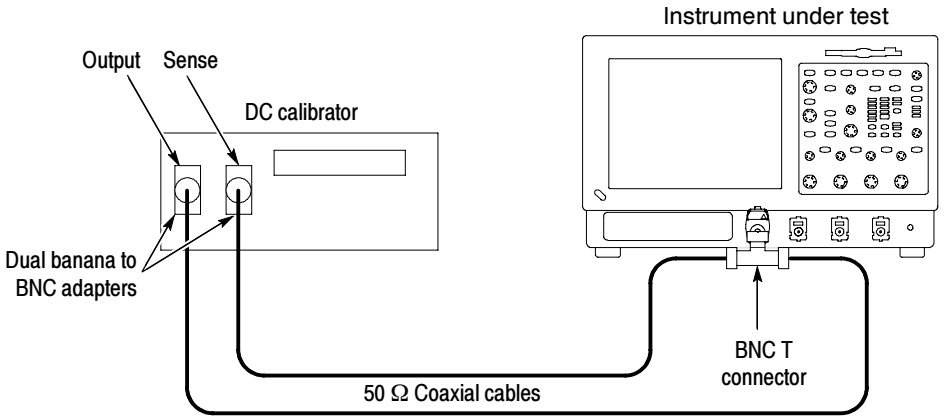

Figure 4- 7: Initial test hookup

b. *Initialize the instrument:* Press **DEFAULT SETUP**.

c. *Modify the default settings:*

- From the tool bar, touch **Horiz** and select the **Acquisition** tab.
- Touch **Average** and set the number of averages to **16**.

2. *Confirm input channels are within limits for DC accuracy at maximum offset and position:* Do the following substeps — test CH 1 first, *skipping substep 2a since CH 1 is already selected from step 1*.

a. *Select an unchecked channel:*

- From the tool bar, touch **MEAS** and then **Clear** to remove the previous measurement.
- Press the Vertical button of the channel just confirmed to remove the channel from the display.
- Press the front-panel Vertical button that corresponds to the channel you are to confirm.
- Set the generator output to 0 V.
- Move the test hookup to the channel you selected.

b. *Turn on the measurement Mean for the channel:*

- From the tool bar, touch **MEAS** and select the **Ampl** tab, then touch **Mean** to measure the mean of the current channel.
- Touch Setup **Statistics** and touch Measurement Statistics **Mean** to display the measurement statistics of the mean measurement.

- Press **Close**.

c. *Set the vertical scale:* Set the vertical **SCALE** to one of the settings listed in Table 4–3 that is not yet checked. (Start with the first setting listed).

Table 4-3: DC Voltage measurement accuracy

Scale setting	Position setting (Divs)	Offset setting1	Generator setting	Accuracy limits
CSA7404B, TDS7404B, TDS7254B, & TDS7154B				
2 mV	-5	+0.5 V	+516 mV	+512.79 mV to +519.21 mV
	+5	-0.5 V	-516 mV	-519.21 mV to -512.79 V
50 mV	-5	+0.5 V	+900 mV	+881.63 mV to +918.38 mV
	+5	-0.5 V	-900 mV	-918.38 mV to -881.63 mV
100 mV	-5	+4.8 V	+5.0 V	+4.9393 V to 5.0607 V
	+5	-4.8 V	-5.0 V	-5.0607 V to -4.9393 V
1 V	-5	+2.5 V	+4.5 V	+4.1738 V to 4.8263 V
	+5	-2.5 V	-4.5 V	-4.8263 V to -4.1738 V
TDS7704B				
2 mV	-5	+0.5 V	+516 mV	+511.99 mV to +520.01 mV
	+5	-0.5 V	-516 mV	-520.01 mV to -511.99 V
50 mV	-5	+0.5 V	+900 mV	+879.75 mV to +920.25 mV
	+5	-0.5 V	-900 mV	-920.25 mV to -879.75 mV
100 mV	-5	+4.8 V	+5.0 V	+4.9298 V to 5.0702 V
	+5	-4.8 V	-5.0 V	-5.0702 V to -4.9298 V
1 V	-5	+2.5 V	+4.5 V	+4.1475 V to 4.8525 V
	+5	-2.5 V	-4.5 V	-4.8525 V to -4.1475 V

1 **Set as precisely as the instrument's offset resolution permits.**

d. *Display the test signal:*

- From the tool bar touch **VERT** and touch **Position**.
- Use the keypad to set vertical position to -5 divisions (press **CLR**, **5**, **-**, and then **ENTER**, on the keypad). The baseline level will move off screen.
- Touch **Offset**.

- Use the keypad to set vertical offset to the positive-polarity setting listed in the table for the current vertical scale setting. The baseline level will remain off screen.
- Set the generator to the level and polarity indicated in the table for the vertical scale, position, and offset settings you have made. (For some settings it is possible that the DC test level appears off screen, while the measured mean value is within tolerance.)

e. *Measure the test signal:* Press **Close**. Read the measurement results at the measurement statistics **µ** measurement readout. See Figure 4–8.

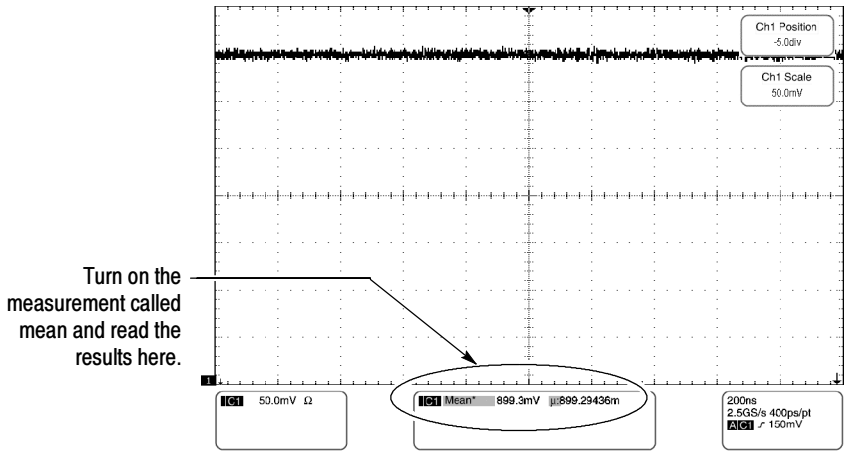

Figure 4-8: Measurement of DC accuracy at maximum offset and position

f. *Check against limits:*

- CHECK that the readout for the measurement **µ** readout on screen is within the limits listed for the current vertical scale and position/offset/generator settings. Enter value on test record.
- Repeat substep d, reversing the polarity of the position, offset, and generator settings as is listed in the table.
- CHECK that the **µ** measurement readout on screen is within the limits listed for the current vertical scale setting and position/offset/generator settings. Enter value on test record.
- Repeat substeps c through f until all vertical scale settings, listed in Table 4–3, are checked for the channel under test.

g. *Test all channels:* Repeat substeps a through f for all four channels.

3. *Disconnect the hookup:*

   a. *Set the generator output to 0 V.*

   b. Disconnect the cable and adapter from the generator output and the input connector of the channel last tested.

Check DC Gain Accuracy

Equipment required	Two dual-banana connectors (Item 5) One BNC T connector (Item 6) One DC calibration generator (Item 9) One SMA male-to-female BNC adapter (Item 19) Two precision 50 Ω coaxial cables (Item 4)
Prerequisites	The instrument must meet the prerequisites listed on page 4–17

WARNING. *The generator is capable of outputting dangerous voltages. Be sure to set the DC calibration generator to off or 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure. Also, check that the calibrator does not have shorting straps installed between the DC output, sense input, or grounds.*

1. *Install the test hookup and preset the instrument controls:*

   a. *Hook up the test-signal source:*

   - Set the output of a DC calibration generator to off or 0 volts.
   - Connect the output of a DC calibration generator through a dual-banana connector followed by a 50 Ω precision coaxial cable to one side of a BNC T connector. See Figure 4–9.
   - Connect the Sense input of the generator through a second dual-banana connector followed by a 50 Ω precision coaxial cable to the other side of the BNC T connector. Now connect the BNC T connector to **CH 1** through an adapter. See Figure 4–9.

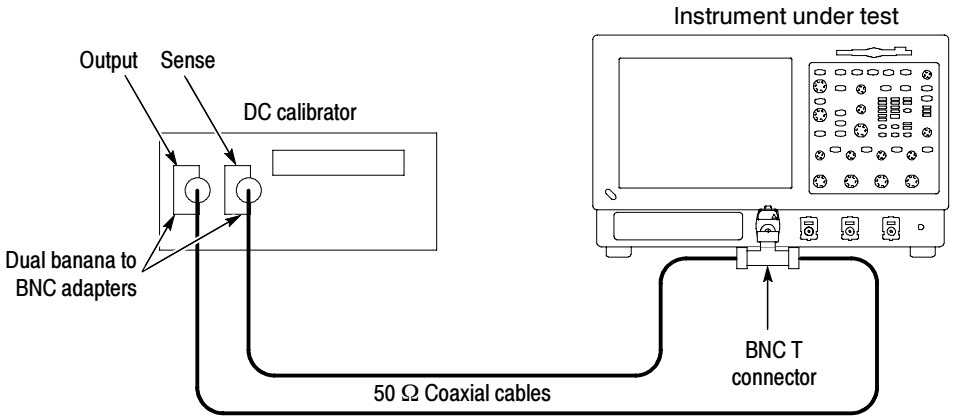

Figure 4- 9: Initial test hookup

b. *Initialize the instrument:* Press **DEFAULT SETUP**.

c. *Modify the default settings:*

- From the tool bar, touch **Horiz** and select the **Acquisition** tab.
- Touch **Average** and set the number of averages to **16**.

2. *Confirm input channels are within limits for DC gain accuracy.* Do the following substeps — test CH 1 first, *skipping substep 2a since CH 1 is already selected from step 1.*

a. *Select an unchecked channel:*

- From the tool bar, touch **MEAS** and then **Clear** to remove the previous measurement.
- Press the Vertical button of the channel just confirmed to remove the channel from the display.
- Press the front-panel Vertical button that corresponds to the channel you are to confirm.
- *Set the generator output to 0 V.*
- Move the test hookup to the channel you selected.

b. *Turn on the measurement Mean for the channel:*

- From the tool bar, touch **MEAS** and select the **Ampl** tab, then touch **Mean** to measure the mean of the current channel.
- Touch Setup **Statistics** and touch Measurement Statistics **Mean** to display the measurement statistics of the mean measurement.

- Press **Close**.

c. *Set the vertical scale:* Set the vertical **SCALE** to one of the settings in Table 4–4 that is not yet checked. (Start with the first setting listed).

Table 4-4: Gain accuracy

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
CSA7404B, TDS7404B, TDS7254B, & TDS7154B							
CH1	2 mV	0	0 V	+7.60 mV			+14.80 mV to +15.60 mV
				-7.60 mV			
		-5	+0.5 V	+517.6 mV			+14.40 mV to +16.00 mV
				+502.4 mV			
		5	-0.5 V	-502.4 mV			+14.40 mV to +16.00 mV
				-517.6 mV			
	5 mV	0	0 V	+19.0 mV			+37.24 mV to +38.76 mV
				-19.0 mV			
		-5	+0.5 V	+544 mV			+36.84 mV to +39.16 mV
				+506 mV			
		5	-0.5 V	-506 mV			+36.84 mV to +39.16 mV
				-544 mV			
	10 mV	0	0 V	+38.0 mV			+74.48 mV to +77.52 mV
				-38.0 mV			
		-5	+0.5 V	+588 mV			+73.64 mV to +78.36 mV
				+512 mV			
		5	-0.5 V	-512 mV			+73.64 mV to +78.36 mV
				-588 mV			
	20 mV	0	0 V	+76.0 mV			+149.0 mV to +155.0 mV
				-76.0 mV			
		-5	+0.5 V	+676.0 mV			+147.1 mV to +156.9 mV
				+524.0 mV			
		5	-0.5 V	-524.0 mV			+147.1 mV to +156.9 mV
				-676.0 mV			
	50 mV	0	0 V	+190 mV			+372.4 mV to +387.6 mV
				-190 mV			
		-5	+0.5 V	+940 mV			+366.7 mV to +393.3 mV

Table 4- 4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
				+560 mV			
		5	-0.5 V	-560 mV			+366.7 mV to +393.3 mV
				-940 mV			
	100 mV	0	0 V	+380 mV			+744.8 mV to +775.2 mV
				-380 mV			
		0	+4.5 V	+4.88 V			+738.0 mV to +782.0 mV
				+4.12 V			
		0	-4.5 V	-4.12 V			+738.0 mV to +782.0 mV
				-4.88 V			
	200 mV	0	0 V	+760 mV			+1.490 V to +1.550 V
				-760 mV			
		2	+4.6 V	+4.96 V			+1.477 V to +1.563 V
				+3.44 V			
		-2	-4.6 V	-3.44 V			+1.477 V to +1.563V
				-4.96 V			
	500 mV	0	0 V	+1.90 V			+3.724 V to +3.876 V
				-1.90 V			
		4	+5 V	+4.90 V			+3.701 V to +3.899 V
				+1.10 V			
		-4	-5 V	-1.10 V			+3.701 V to +3.899 V
				-4.90 V			
	1 V	0	0 V	+3.80 V			+7.448 V to +7.752 V
				-3.80 V			
		0	+2.0 V	+5.00 V			+5.856 V to +6.144 V
				-1.00 V			
		0	-2.0 V	+1.00 V			+5.856 V to +6.144 V
				-5.00 V			

Table 4-4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
CH2	2 mV	0	0 V	+7.60 mV			+14.80 mV to +15.60 mV
				-7.60 mV			
		-5	+0.5 V	+517.6 mV			+14.40 mV to +16.00 mV
				+502.4 mV			
		5	-0.5 V	-502.4 mV			+14.40 mV to +16.00 mV
				-517.6 mV			
	5 mV	0	0 V	+19.0 mV			+37.24 mV to +38.76 mV
				-19.0 mV			
		-5	+0.5 V	+544 mV			+36.84 mV to +39.16 mV
				+506 mV			
		5	-0.5 V	-506 mV			+36.84 mV to +39.16 mV
				-544 mV			
	10 mV	0	0 V	+38.0 mV			+74.48 mV to +77.52 mV
				-38.0 mV			
		-5	+0.5 V	+588 mV			+73.64 mV to +78.36 mV
				+512 mV			
		5	-0.5 V	-512 mV			+73.64 mV to +78.36 mV
				-588 mV			
	20 mV	0	0 V	+76.0 mV			+149.0 mV to +155.0 mV
				-76.0 mV			
		-5	+0.5 V	+676.0 mV			+147.1 mV to +156.9 mV
				+524.0 mV			
		5	-0.5 V	-524.0 mV			+147.1 mV to +156.9 mV
				-676.0 mV			
	50 mV	0	0 V	+190 mV			+372.4 mV to +387.6 mV
				-190 mV			
		-5	+0.5 V	+940 mV			+366.7 mV to +393.3 mV
				+560 mV			
		5	-0.5 V	-560 mV			+366.7 mV to +393.3 mV
				-940 mV			
	100 mV	0	0 V	+380 mV			+744.8 mV to +775.2 mV

Table 4- 4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
				-380 mV			
		0	+4.5 V	+4.88 V			+738.0 mV to +782.0 mV
				+4.12 V			
		0	-4.5 V	-4.12 V			+738.0 mV to +782.0 mV
				-4.88 V			
	200 mV	0	0 V	+760 mV			+1.490 V to +1.550 V
				-760 mV			
		2	+4.6 V	+4.96 V			+1.477 V to +1.563 V
				+3.44 V			
		-2	-4.6 V	-3.44 V			+1.477 V to +1.563V
				-4.96 V			
	500 mV	0	0 V	+1.90 V			+3.724 V to +3.876 V
				-1.90 V			
		4	+5 V	+4.90 V			+3.701 V to +3.899 V
				+1.10 V			
		-4	-5 V	-1.10 V			+3.701 V to +3.899 V
				-4.90 V			
	1 V	0	0 V	+3.80 V			+7.448 V to +7.752 V
				-3.80 V			
		0	+2.0 V	+5.00 V			+5.856 V to +6.144 V
				-1.00 V			
		0	-2.0 V	+1.00 V			+5.856 V to +6.144 V
				-5.00 V			

Table 4-4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
CH3	2 mV	0	0 V	+7.60 mV			+14.80 mV to +15.60 mV
				-7.60 mV			
		-5	+0.5 V	+517.6 mV			+14.40 mV to +16.00 mV
				+502.4 mV			
		5	-0.5 V	-502.4 mV			+14.40 mV to +16.00 mV
				-517.6 mV			
	5 mV	0	0 V	+19.0 mV			+37.24 mV to +38.76 mV
				-19.0 mV			
		-5	+0.5 V	+544 mV			+36.84 mV to +39.16 mV
				+506 mV			
		5	-0.5 V	-506 mV			+36.84 mV to +39.16 mV
				-544 mV			
	10 mV	0	0 V	+38.0 mV			+74.48 mV to +77.52 mV
				-38.0 mV			
		-5	+0.5 V	+588 mV			+73.64 mV to +78.36 mV
				+512 mV			
		5	-0.5 V	-512 mV			+73.64 mV to +78.36 mV
				-588 mV			
	20 mV	0	0 V	+76.0 mV			+149.0 mV to +155.0 mV
				-76.0 mV			
		-5	+0.5 V	+676.0 mV			+147.1 mV to +156.9 mV
				+524.0 mV			
		5	-0.5 V	-524.0 mV			+147.1 mV to +156.9 mV
				-676.0 mV			
	50 mV	0	0 V	+190 mV			+372.4 mV to +387.6 mV
				-190 mV			
		-5	+0.5 V	+940 mV			+366.7 mV to +393.3 mV
				+560 mV			
		5	-0.5 V	-560 mV			+366.7 mV to +393.3 mV
				-940 mV			
	100 mV	0	0 V	+380 mV			+744.8 mV to +775.2 mV

Table 4- 4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
				-380 mV			
		0	+4.5 V	+4.88 V			+738.0 mV to +782.0 mV
				+4.12 V			
		0	-4.5 V	-4.12 V			+738.0 mV to +782.0 mV
				-4.88 V			
	200 mV	0	0 V	+760 mV			+1.490 V to +1.550 V
				-760 mV			
		2	+4.6 V	+4.96 V			+1.477 V to +1.563 V
				+3.44 V			
		-2	-4.6 V	-3.44 V			+1.477 V to +1.563V
				-4.96 V			
	500 mV	0	0 V	+1.90 V			+3.724 V to +3.876 V
				-1.90 V			
		4	+5 V	+4.90 V			+3.701 V to +3.899 V
				+1.10 V			
		-4	-5 V	-1.10 V			+3.701 V to +3.899 V
				-4.90 V			
	1 V	0	0 V	+3.80 V			+7.448 V to +7.752 V
				-3.80 V			
		0	+2.0 V	+5.00 V			+5.856 V to +6.144 V
				-1.00 V			
		0	-2.0 V	+1.00 V			+5.856 V to +6.144 V
				-5.00 V			

Table 4-4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
CH4	2 mV	0	0 V	+7.60 mV			+14.80 mV to +15.60 mV
				-7.60 mV			
		-5	+0.5 V	+517.6 mV			+14.40 mV to +16.00 mV
				+502.4 mV			
		5	-0.5 V	-502.4 mV			+14.28 mV to +16.00 mV
				-517.6 mV			
	5 mV	0	0 V	+19.0 mV			+37.40 mV to +38.76 mV
				-19.0 mV			
		-5	+0.5 V	+544 mV			+36.84 mV to +39.16 mV
				+506 mV			
		5	-0.5 V	-506 mV			+36.84 mV to +39.16 mV
				-544 mV			
	10 mV	0	0 V	+38.0 mV			+74.48 mV to +77.52 mV
				-38.0 mV			
		-5	+0.5 V	+588 mV			+73.64 mV to +78.36 mV
				+512 mV			
		5	-0.5 V	-512 mV			+73.64 mV to +78.36 mV
				-588 mV			
	20 mV	0	0 V	+76.0 mV			+149.0 mV to +155.0 mV
				-76.0 mV			
		-5	+0.5 V	+676.0 mV			+147.1 mV to +156.9 mV
				+524.0 mV			
		5	-0.5 V	-524.0 mV			+147.1 mV to +156.9 mV
				-676.0 mV			
	50 mV	0	0 V	+190 mV			+372.4 mV to +387.6 mV
				-190 mV			
		-5	+0.5 V	+940 mV			+366.7 mV to +393.3 mV
				+560 mV			
		5	-0.5 V	-560 mV			+366.7 mV to +393.3 mV
				-940 mV			
	100 mV	0	0 V	+380 mV			+744.8 mV to +775.2 mV

Table 4- 4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
				-380 mV			
		0	+4.5 V	+4.88 V			+738.0 mV to +782.0 mV
				+4.12 V			
		0	-4.5 V	-4.12 V			+738.0 mV to +782.0 mV
				-4.88 V			
	200 mV	0	0 V	+760 mV			+1.490 V to +1.550 V
				-760 mV			
		2	+4.6 V	+4.96 V			+1.477 V to +1.563 V
				+3.44 V			
		-2	-4.6 V	-3.44 V			+1.477 V to +1.563V
				-4.96 V			
	500 mV	0	0 V	+1.90 V			+3.724 V to +3.876 V
				-1.90 V			
		4	+5 V	+4.90 V			+3.701 V to +3.899 V
				+1.10 V			
		-4	-5 V	-1.10 V			+3.701 V to +3.899 V
				-4.90 V			
	1 V	0	0 V	+3.80 V			+7.448 V to +7.752 V
				-3.80 V			
		0	+2.0 V	+5.00 V			+5.856 V to +6.144 V
				-1.00 V			
		0	-2.0 V	+1.00 V			+5.856 V to +6.144 V
				-5.00 V			

Table 4-4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
TDS7704B							
CH1	2 mV	0	0 V	+7.60 mV			+14.74 mV to +15.66 mV
				-7.60 mV			
		-5	+0.5 V	+517.6 mV			+14.28 mV to +16.12 mV
				+502.4 mV			
		5	-0.5 V	-502.4 mV			+14.28 mV to +16.12 mV
				-517.6 mV			
	5 mV	0	0 V	+19.0 mV			+37.05 mV to +38.95 mV
				-19.0 mV			
		-5	+0.5 V	+544 mV			+36.65 mV to +39.35 mV
				+506 mV			
		5	-0.5 V	-506 mV			+36.65 mV to +39.35 mV
				-544 mV			
	10 mV	0	0 V	+38.0 mV			+74.10 mV to +77.90 mV
				-38.0 mV			
		-5	+0.5 V	+588 mV			+73.26 mV to +78.74 mV
				+512 mV			
		5	-0.5 V	-512 mV			+73.26 mV to +78.74 mV
				-588 mV			
	20 mV	0	0 V	+76.0 mV			+148.2 mV to +155.8 mV
				-76.0 mV			
		-5	+0.5 V	+676 mV			+146.4 mV to +157.6 mV
				+524 mV			
		5	-0.5 V	-524 mV			+146.4 mV to +157.6 mV
				-676 mV			
	50 mV	0	0 V	+190 mV			+370.5 mV to +389.5 mV
				-190 mV			
		-5	+0.5 V	+940 mV			+364.8 mV to +395.2 mV
				+560 mV			
		5	-0.5 V	-560 mV			+364.8 mV to +395.2 mV
				-940 mV			

Table 4- 4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
	100 mV	0	0 V	+380 mV			+741.0 mV to +779.0 mV
				-380 mV			
		0	+4.5 V	+4.88 V			+734.2 mV to +785.8 mV
				+4.12 V			
		0	-4.5 V	-4.12 V			+734.2 mV to +785.8 mV
				-4.88V			
	200 mV	0	0 V	+760 mV			+1.482 V to +1.558 V
				-760 mV			
		2	+4.6 V	+4.96 V			+1.469 V to +1.571 V
				+3.44 V			
		-2	-4.6 V	-3.44 V			+1.469 V to +1.571 V
				-4.96 V			
	500 mV	0	0 V	+1.90 V			+3.705 V to +3.895 V
				-1.90 V			
		4	+5 V	+4.90 V			+3.682 V to +3.918 V
				+1.10 V			
		-4	-5 V	-1.10 V			+3.682 V to +3.918 V
				-4.90 V			
	1 V	0	0 V	+3.80 V			+7.410 V to +7.790 V
				-3.80 V			
		0	+2.0 V	+5.00 V			+5.826 V to +6.174 V
				-1.00 V			
		0	-2.0 V	+1.00 V			+5.826 V to +6.174 V
				-5.00 V			

Table 4-4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
CH2	2 mV	0	0 V	+7.60 mV			+14.74 mV to +15.66 mV
				-7.60 mV			
		-5	+0.5 V	+517.6 mV			+14.28 mV to +16.12 mV
				+502.4 mV			
		5	-0.5 V	-502.4 mV			+14.28 mV to +16.12 mV
				-517.6 mV			
	5 mV	0	0 V	+19.0 mV			+37.05 mV to +38.95 mV
				-19.0 mV			
		-5	+0.5 V	+544 mV			+36.65 mV to +39.35 mV
				+506 mV			
		5	-0.5 V	-506 mV			+36.65 mV to +39.35 mV
				-544 mV			
	10 mV	0	0 V	+38.0 mV			+74.10 mV to +77.90 mV
				-38.0 mV			
		-5	+0.5 V	+588 mV			+73.26 mV to +78.74 mV
				+512 mV			
		5	-0.5 V	-512 mV			+73.26 mV to +78.74 mV
				-588 mV			
	20 mV	0	0 V	+76.0 mV			+148.2 mV to +155.8 mV
				-76.0 mV			
		-5	+0.5 V	+676 mV			+146.4 mV to +157.6 mV
				+524 mV			
		5	-0.5 V	-524 mV			+146.4 mV to +157.6 mV
				-676 mV			
	50 mV	0	0 V	+190 mV			+370.5 mV to +389.5 mV
				-190 mV			
		-5	+0.5 V	+940 mV			+364.8 mV to +395.2 mV
				+560 mV			
		5	-0.5 V	-560 mV			+364.8 mV to +395.2 mV
				-940 mV			
	100 mV	0	0 V	+380 mV			+741.0 mV to +779.0 mV

Table 4- 4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
				-380 mV			
		0	+4.5 V	+4.88 V			+734.2 mV to +785.8 mV
				+4.12 V			
		0	-4.5 V	-4.12 V			+734.2 mV to +785.8 mV
				-4.88V			
	200 mV	0	0 V	+760 mV			+1.482 V to +1.558 V
				-760 mV			
		2	+4.6 V	+4.96 V			+1.469 V to +1.571 V
				+3.44 V			
		-2	-4.6 V	-3.44 V			+1.469 V to +1.571 V
				-4.96 V			
	500 mV	0	0 V	+1.90 V			+3.705 V to +3.895 V
				-1.90 V			
		4	+5 V	+4.90 V			+3.682 V to +3.918 V
				+1.10 V			
		-4	-5 V	-1.10 V			+3.682 V to +3.918 V
				-4.90 V			
	1 V	0	0 V	+3.80 V			+7.410 V to +7.790 V
				-3.80 V			
		0	+2.0 V	+5.00 V			+5.826 V to +6.174 V
				-1.00 V			
		0	-2.0 V	+1.00 V			+5.826 V to +6.174 V
				-5.00 V			

Table 4-4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
CH3	2 mV	0	0 V	+7.60 mV			+14.74 mV to +15.66 mV
				-7.60 mV			
		-5	+0.5 V	+517.6 mV			+14.28 mV to +16.12 mV
				+502.4 mV			
		5	-0.5 V	-502.4 mV			+14.28 mV to +16.12 mV
				-517.6 mV			
	5 mV	0	0 V	+19.0 mV			+37.05 mV to +38.95 mV
				-19.0 mV			
		-5	+0.5 V	+544 mV			+36.65 mV to +39.35 mV
				+506 mV			
		5	-0.5 V	-506 mV			+36.65 mV to +39.35 mV
				-544 mV			
	10 mV	0	0 V	+38.0 mV			+74.10 mV to +77.90 mV
				-38.0 mV			
		-5	+0.5 V	+588 mV			+73.26 mV to +78.74 mV
				+512 mV			
		5	-0.5 V	-512 mV			+73.26 mV to +78.74 mV
				-588 mV			
	20 mV	0	0 V	+76.0 mV			+148.2 mV to +155.8 mV
				-76.0 mV			
		-5	+0.5 V	+676 mV			+146.4 mV to +157.6 mV
				+524 mV			
		5	-0.5 V	-524 mV			+146.4 mV to +157.6 mV
				-676 mV			
	50 mV	0	0 V	+190 mV			+370.5 mV to +389.5 mV
				-190 mV			
		-5	+0.5 V	+940 mV			+364.8 mV to +395.2 mV
				+560 mV			
		5	-0.5 V	-560 mV			+364.8 mV to +395.2 mV
				-940 mV			
	100 mV	0	0 V	+380 mV			+741.0 mV to +779.0 mV

Table 4-4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
				-380 mV			
		0	+4.5 V	+4.88 V			+734.2 mV to +785.8 mV
				+4.12 V			
		0	-4.5 V	-4.12 V			+734.2 mV to +785.8 mV
				-4.88V			
	200 mV	0	0 V	+760 mV			+1.482 V to +1.558 V
				-760 mV			
		2	+4.6 V	+4.96 V			+1.469 V to +1.571 V
				+3.44 V			
		-2	-4.6 V	-3.44 V			+1.469 V to +1.571 V
				-4.96 V			
	500 mV	0	0 V	+1.90 V			+3.705 V to +3.895 V
				-1.90 V			
		4	+5 V	+4.90 V			+3.682 V to +3.918 V
				+1.10 V			
		-4	-5 V	-1.10 V			+3.682 V to +3.918 V
				-4.90 V			
	1 V	0	0 V	+3.80 V			+7.410 V to +7.790 V
				-3.80 V			
		0	+2.0 V	+5.00 V			+5.826 V to +6.174 V
				-1.00 V			
		0	-2.0 V	+1.00 V			+5.826 V to +6.174 V
				-5.00 V			

Table 4-4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
CH4	2 mV	0	0 V	+7.60 mV			+14.74 mV to +15.66 mV
				-7.60 mV			
		-5	+0.5 V	+517.6 mV			+14.28 mV to +16.12 mV
				+502.4 mV			
		5	-0.5 V	-502.4 mV			+14.28 mV to +16.12 mV
				-517.6 mV			
	5 mV	0	0 V	+19.0 mV			+37.05 mV to +38.95 mV
				-19.0 mV			
		-5	+0.5 V	+544 mV			+36.65 mV to +39.35 mV
				+506 mV			
		5	-0.5 V	-506 mV			+36.65 mV to +39.35 mV
				-544 mV			
	10 mV	0	0 V	+38.0 mV			+74.10 mV to +77.90 mV
				-38.0 mV			
		-5	+0.5 V	+588 mV			+73.26 mV to +78.74 mV
				+512 mV			
		5	-0.5 V	-512 mV			+73.26 mV to +78.74 mV
				-588 mV			
	20 mV	0	0 V	+76.0 mV			+148.2 mV to +155.8 mV
				-76.0 mV			
		-5	+0.5 V	+676 mV			+146.4 mV to +157.6 mV
				+524 mV			
		5	-0.5 V	-524 mV			+146.4 mV to +157.6 mV
				-676 mV			
	50 mV	0	0 V	+190 mV			+370.5 mV to +389.5 mV
				-190 mV			
		-5	+0.5 V	+940 mV			+364.8 mV to +395.2 mV
				+560 mV			
		5	-0.5 V	-560 mV			+364.8 mV to +395.2 mV
				-940 mV			
	100 mV	0	0 V	+380 mV			+741.0 mV to +779.0 mV

Table 4- 4: Gain accuracy (Cont.)

Channel	Scale setting	Position setting (Divs)	Offset setting	Generator setting	Measurement mean	Difference of measurement means	Accuracy limits
				-380 mV			
		0	+4.5 V	+4.88 V			+734.2 mV to +785.8 mV
				+4.12 V			
		0	-4.5 V	-4.12 V			+734.2 mV to +785.8 mV
				-4.88V			
	200 mV	0	0 V	+760 mV			+1.482 V to +1.558 V
				-760 mV			
		2	+4.6 V	+4.96 V			+1.469 V to +1.571 V
				+3.44 V			
		-2	-4.6 V	-3.44 V			+1.469 V to +1.571 V
				-4.96 V			
	500 mV	0	0 V	+1.90 V			+3.705 V to +3.895 V
				-1.90 V			
		4	+5 V	+4.90 V			+3.682 V to +3.918 V
				+1.10 V			
		-4	-5 V	-1.10 V			+3.682 V to +3.918 V
				-4.90 V			
	1 V	0	0 V	+3.80 V			+7.410 V to +7.790 V
				-3.80 V			
		0	+2.0 V	+5.00 V			+5.826 V to +6.174 V
				-1.00 V			
		0	-2.0 V	+1.00 V			+5.826 V to +6.174 V
				-5.00 V			

d. *Display the test signal:*

- From the tool bar touch **VERT** and then touch **Position**.
- Use the keypad to set vertical position to the number of divisions listed in the table for the current vertical scale setting and offset.
- Touch **Offset**.

- Use the keypad to set vertical offset to the setting listed in the table for the current vertical scale and position settings. The baseline level may move off screen.
- Set the generator to the level and polarity indicated in the table for the vertical scale, position, and offset settings you have made. The DC test level may be off screen. For all steps except the ones on the 1 V/div range, adjust the vertical offset setting as needed to bring the DC test level to +3.8 divisions (0.2 divisions below the top of the graticule).

e. *Measure the test signal:* Press **Close**.

- Read the measurement results at the measurement statistics **μ** measurement readout. See Figure 4–10.
- Record the Mean in the Measurement Mean column of Table 4–4.

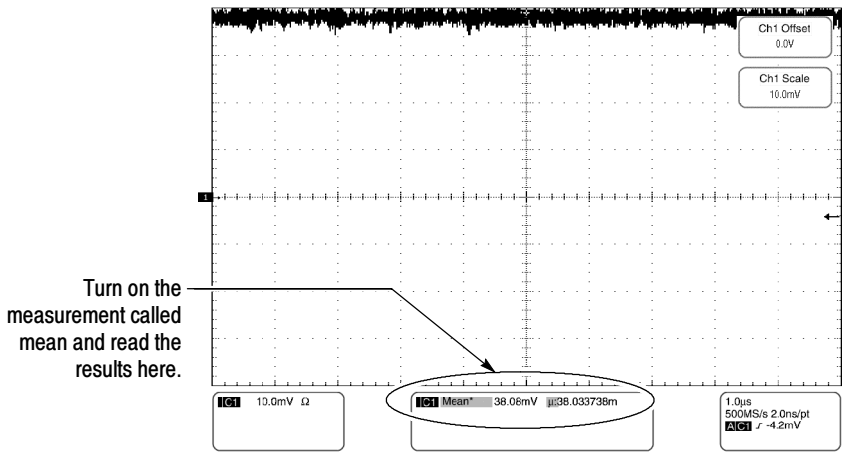

Figure 4- 10: Measurement of DC gain accuracy

f. *Measure second mean:*

- Set the generator to the second level and polarity indicated in the table for the vertical scale, position, and offset settings you have made. (For some settings it is possible that the DC test level appears off screen, while the measured mean value is within tolerance.)
- Repeat substep e using the current vertical scale, position, offset, and new generator setting for the second mean.

g. *Check against limits:*

- Subtract the second measurement mean from the first measurement mean for the current vertical scale, position, and offset.

- Record the difference of the two mean measurements in the Difference of Measurement Means column of Table 4–4.
- CHECK that the Difference of Measurement Mean is within the limits listed for the current vertical scale/position/offset/generator settings. Enter measurement mean difference value on test record.

h. *Repeat substeps:*

- Repeat substeps d through g, using the next position, offset and generator settings listed in the table for the current vertical scale.
- Repeat substeps d through g, using the next position, offset and generator settings listed in the table for the current vertical scale.

i. Repeat substeps c through h until all vertical scale settings, listed in Table 4–4, are checked for the channel under test.

j. *Test all channels:* Repeat substeps a through i for all four channels.

3. *Disconnect the hookup:*

a. *Set the generator output to 0 V.*

b. Disconnect the cable and adapter from the generator output and the input connector of the channel last tested.

Check Offset Accuracy

Equipment required	Two dual-banana connectors (Item 5) One BNC T connector (Item 6) One DC calibration generator (Item 9) One SMA male-to-female BNC adapter (Item 19) Two precision 50 Ω coaxial cables (Item 4)
Prerequisites	The instrument must meet the prerequisites listed on page 4-17

WARNING. *The generator is capable of outputting dangerous voltages. Be sure to set the DC calibration generator to off or 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure. Also, check that the calibrator does not have shorting straps installed between the DC output, sense input, or grounds.*

1. *Install the test hookup and preset the instrument controls:*

   a. *Hook up the test-signal source:*

      - Set the output of a DC calibration generator to off or 0 volts.
      - Connect the output of a DC calibration generator through a dual-banana connector followed by a 50 Ω precision coaxial cable to one side of a BNC T connector. See Figure 4–11.
      - Connect the Sense input of the generator through a second dual-banana connector followed by a 50 Ω precision coaxial cable to the other side of the BNC T connector. Now connect the BNC T connector to **CH 1** through an adapter. See Figure 4–11.

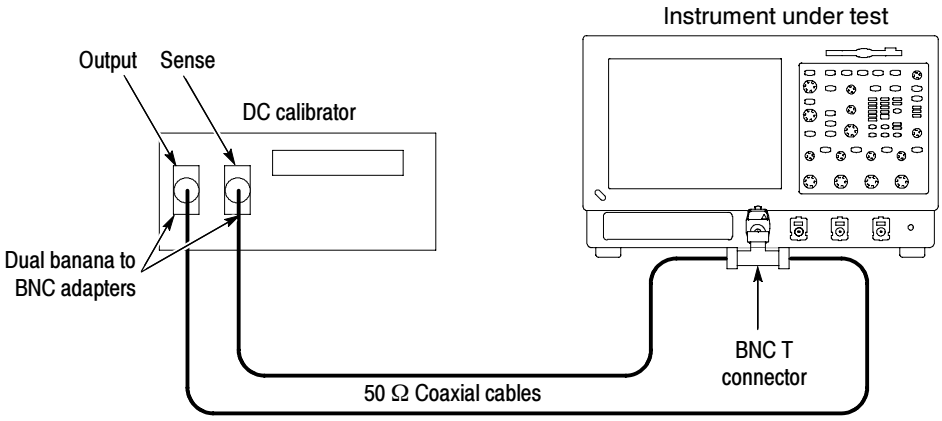

Figure 4- 11: Initial test hookup

   b. *Initialize the instrument:* Press **DEFAULT SETUP**.

   c. *Modify the default settings:*

      - From the tool bar, touch **Horiz** and select the **Acquisition** tab.
      - Touch **Average** and set the number of averages to **16**.

2. *Confirm input channels are within limits for offset accuracy.* Do the following substeps — test CH 1 first, *skipping substep 2a since CH 1 is already selected from step 1.*

   a. *Select an unchecked channel:*

      - From the tool bar, touch **MEAS** and then **Clear** to remove the previous measurement.
      - Press the Vertical button of the channel just confirmed to remove the channel from the display.

- Press the front-panel Vertical button that corresponds to the channel you are to confirm.
- *Set the generator output to 0 V.*
- Move the test hookup to the channel you selected.

b. *Turn on the measurement Mean for the channel:*

- From the tool bar, touch **MEAS** and select the **Ampl** tab, then touch **Mean** to measure the mean of the current channel.
- Press **Close**.

c. *Set the vertical scale:* Set the vertical **SCALE** to one of the settings in Table 4–5 that is not yet checked.

Table 4-5: Offset accuracy

Scale setting	Position setting (Divs)	Offset setting[1]	Generator setting	Accuracy limits
CSA7404B, TDS7404B, TDS7254B, & TDS7154B				
2 mV	0	+0.5 V	+500 mV	+497.3 mV to +502.7 mV
		0 V	0.0 mV	-1.7 mV to +1.7 mV
		-0.5 V	-500 mV	-502.7 mV to -497.3 mV
50 mV	0	+0.5 V	+500 mV	+491.75 mV to +508.25 mV
		0 V	0.0 mV	-6.5 mV to +6.5 mV
		-0.5 V	-500 mV	-508.25 mV to -491.75 mV
100 mV	0	+5 V	+5.0 V	+4.9575 V to +5.0425 V
		0 V	0.0 V	-25 mV to +25 mV
		-5 V	-5.0 V	-5.0425 V to -4.9575 V
500 mV	0	+5 V	+5.0 V	+4.9175 V to +5.0825 V
		0 V	0.0 V	-65 mV to +65 mV
		-5 V	-5.0 V	-5.0825 V to -4.9175 V
1 V	0	+2.5 V	+2.5 V	+2.37625 V to +2.62375 V
		0 V	0.0 V	-115 mV to +115 mV
		-2.5 V	-2.5 V	-2.62375 V to -2.37625 V
TDS7704B				
2 mV	0	+0.5 V	+500 mV	+496.55 mV to +503.45 mV
		0 V	0.0 mV	-1.7 mV to +1.7 mV
		-0.5 V	-500 mV	-503.45 mV to -496.55 mV

Table 4-5: Offset accuracy (Cont.)

Scale setting	Position setting (Divs)	Offset setting[1]	Generator setting	Accuracy limits
50 mV	0	+0.5 V	+500 mV	+491.00 mV to +509.00 mV
		0 V	0.0 mV	-6.50 mV to +6.50 mV
		-0.5 V	-500 mV	-509.00 mV to -491.00 mV
100 mV	0	+5 V	+5.0 V	+4.95 V to +5.05 V
		0 V	0.0 V	-25 mV to +25 mV
		-5 V	-5.0 V	-5.05 V to -4.95 V
500 mV	0	+5 V	+5.0 V	+4.91 V to +5.09 V
		0 V	0.0 V	-65 mV to +65 mV
		-5 V	-5.0 V	-5.09 V to -4.91 V
1 V	0	+2.5 V	+2.5 V	+2.3725 V to +2.6275 V
		0 V	0.0 V	-115 mV to +115 mV
		-2.5 V	-2.5 V	-2.6275 V to -2.3725 V

[1] **Set as precisely as the instrument's offset resolution permits.**

d. *Display the test signal:*

- From the tool bar touch **VERT** and then touch **Position**.
- Use the keypad to set vertical position to 0.0 divisions (press **CLR** and then **ENTER**, on the keypad).
- Touch **Offset**.
- Use the keypad to set vertical offset to the positive-polarity setting listed in the table for the current vertical scale setting. The baseline level may move off screen.
- Set the generator to the level and polarity indicated in the table for the vertical scale, position, and offset settings you have made. The DC test level should appear on screen. (If it doesn't return, the offset accuracy check has failed for the current vertical scale setting of the current channel).

e. *Measure the test signal:* Press **Close**. Read the measurement results at the **Mean** measurement readout. See Figure 4–12.

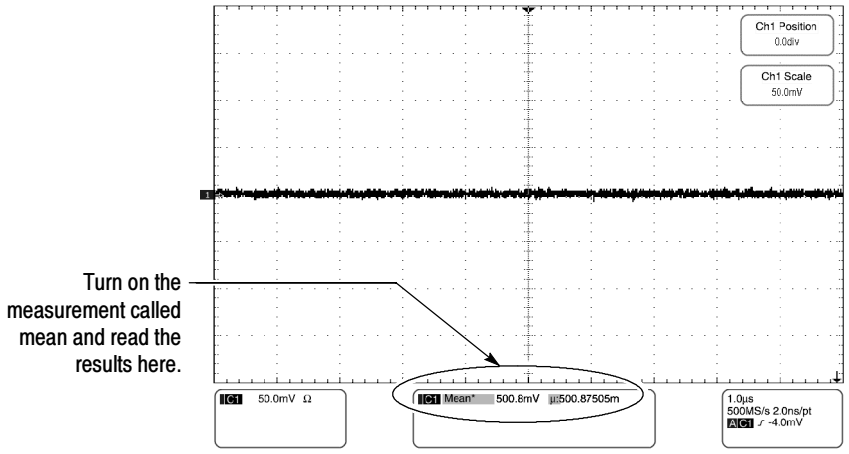

Figure 4- 12: Measurement of offset accuracy

f. *Check against limits:*

- CHECK that the readout for the measurement **Mean** readout on screen is within the limits listed for the current vertical scale and position/offset/generator settings. Enter the value on the test record.
- Repeat substep d, using the zero offset and generator settings as is listed in the table.
- CHECK that the **Mean** measurement readout on screen is within the limits listed for the current vertical scale setting and position/offset/ generator settings. Enter the value on the test record.
- Repeat substep d, using the negative-polarity offset and generator settings as is listed in the table.
- CHECK that the **Mean** measurement readout on screen is within the limits listed for the current vertical scale setting and position/offset/ generator settings. Enter the value on the test record.
- Repeat substeps c through f until all vertical scale settings, listed in Table 4–5, are checked for the channel under test.

g. *Test all channels:* Repeat substeps a through f for all four channels.

3. *Disconnect the hookup:*

a. *Set the generator output to 0 V.*

b. Disconnect the cable and adapter from the generator output and the input connector of the channel last tested.

Check Maximum Input Voltage

Equipment required	Two dual-banana connectors (Item 5) One BNC T connector (Item 6) One 10X attenuator (Item 1) One DC calibration generator (Item 9) One SMA male-to-female BNC adapter (Item 19) Two precision 50 Ω coaxial cables (Item 4)
Prerequisites	The instrument must meet the prerequisites listed on page 4–17

WARNING. *The generator is capable of outputting dangerous voltages. Be sure to set the DC calibration generator to off or 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure. Also, check that the calibrator does not have shorting straps installed between the DC output, sense input, or grounds.*

1. *Install the test hookup and preset the instrument controls:*

   a. *Hook up the test-signal source:*

   - Set the output of a DC calibration generator to off or 0 volts.
   - Connect the output of a DC calibration generator through a dual-banana connector followed by a 50 Ω precision coaxial cable to one side of a BNC T connector. See Figure 4–13.
   - Connect the Sense input of the generator through a second dual-banana connector followed by a 50 Ω precision coaxial cable to the other side of the BNC T connector. Now connect the BNC T connector to **CH 1** through a 10X attenuator and an adapter. See Figure 4–13.

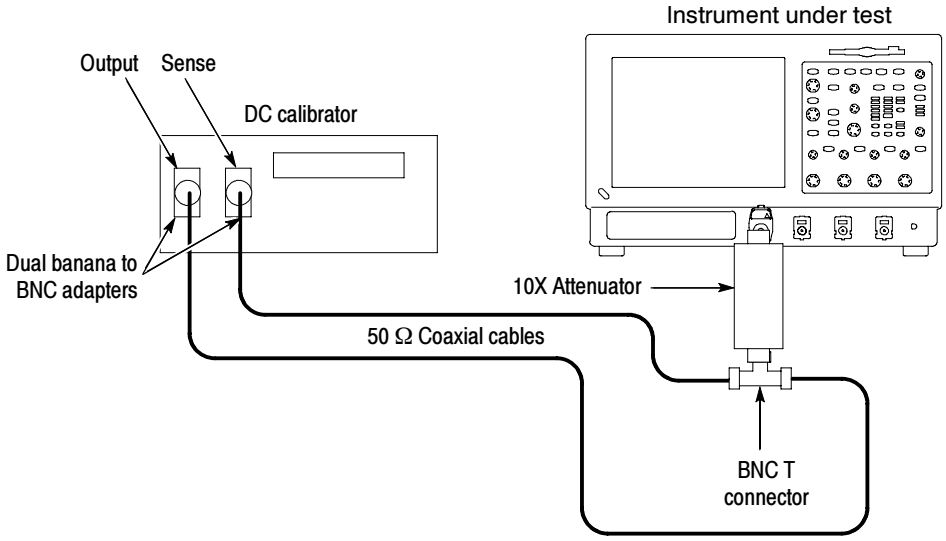

Figure 4- 13: Initial test hookup

b. *Initialize the instrument:* Press **DEFAULT SETUP**.

c. *Modify the default settings:*

- From the tool bar, touch **Horiz** and select the **Acquisition** tab.
- Touch **Average** and set the number of averages to **16**.

2. *Confirm input channels are within limits for maximum input voltage:* Do the following substeps — test CH 1 first, *skipping substep 2a since CH 1 is already selected from step 1.*

a. *Select an unchecked channel:*

- From the tool bar, touch **MEAS** and then **Clear** to remove the previous measurement.
- Press the Vertical button of the channel just confirmed to remove the channel from the display.
- Press the front-panel Vertical button that corresponds to the channel you are to confirm.
- *Set the generator output to 0 V.*
- Move the test hookup to the channel you selected.

b. *Turn on the measurement High for the channel:*

- From the tool bar, touch **MEAS** and select the **Ampl** tab, then touch **High** to measure the high of the current channel.

- Press **Close**.

c. *Set the vertical scale:*

- Set the vertical **SCALE** to one of the settings listed in Table 4–6 that is not yet checked. (Start with the first setting listed).
- From the tool bar touch **VERT** and touch **Position**.
- Use the keypad to set vertical position to –3 divisions (press **CLR**, **3**, **–**, and then **ENTER**, on the keypad).
- Set the Coupling to **DC**.
- Touch **Offset**.
- Use the keypad to set vertical offset to 0 V.
- Press **Close**.

Table 4-6: Maximum input voltage limit

Scale setting	Position setting (Divs)	Offset setting	Generator setting	Readout with 10X attenuator	Limits (without 10X attenuator)
CSA7404B, TDS7404B, TDS7254B, & TDS7154B					
50 mV	-3	0 V	+1 V	+100 mV	Coupling in CH readout stays Ω
			+3 V	+300 mV	Coupling changes to ground
1 V	-3	0 V	+5 V	+500 mV	Coupling in CH readout stays Ω
			+10 V	+1.0 V	Coupling changes to ground
TDS7704B					
50 mV	-3	0 V	+1 V	+100 mV	Coupling in CH readout stays Ω
			+3 V	+300 mV	Coupling changes to ground
1 V	-3	0 V	+6.5 V	+650 mV	Coupling in CH readout stays Ω
			+10 V	+1.0 V	Coupling changes to ground

d. *Display the test signal:* Set the generator to the level and polarity indicated in the table for the vertical scale, position, and offset settings you have made, or set the generator for the readout indicated in the table for the vertical scale, position, and offset settings you have made. See Figure 4–14.

***NOTE**. When setting the Fluke 9500B to output more than 5 V, use the following procedure:*
*Press the **Aux** button*
Press the fourth soft key down (Selects the pulse with an exclamation point)
Set the amplitude to 6.5 V or 10 V
*Press the **->|** key to select the pulse energy*
Set the energy to 50J
*Press the Output **On** key*
*Press the **Trig Pulse** soft key to trigger the pulse (this will generate a pulse with 59.172, 30.864, and 25 seconds duration respectively).*

Use the normal DC output for the 1 V, 3 V, and 5 V generator settings.

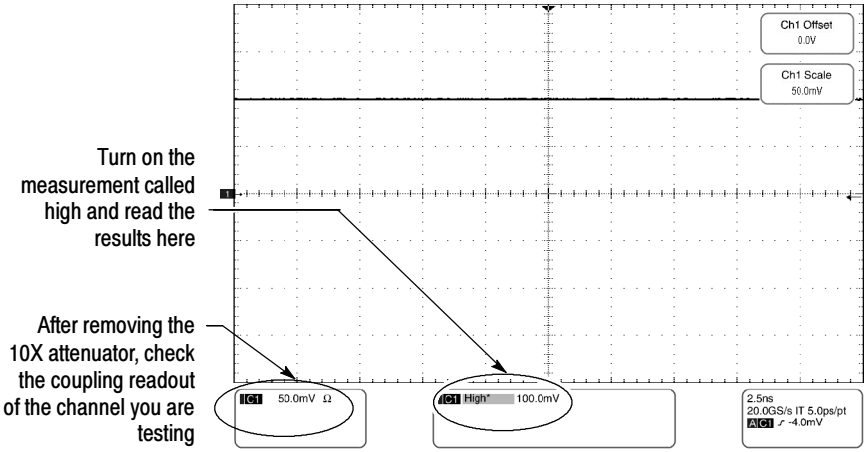

Figure 4-14: Check of maximum input voltage

e. *Check an unchecked generator setting against limits:*

- Remove the 10X attenuator.
- CHECK that the coupling readout on screen for the selected channel is as listed for the current vertical scale and position/offset/generator settings. Enter result on test record.
- Reinstall the 10X attenuator.

f. *Check the next generator setting:* Repeat substeps d and e, using the new generator setting as is listed in the table.

g. *Check the remaining vertical scale settings:* Repeat substeps c through f until all vertical scale settings, listed in Table 4–6, are checked for the channel under test.

h. *Test all channels:* Repeat substeps a through g for all vertical channels.

3. *Disconnect the hookup:*

a. *Set the generator output to 0 V.*

b. Disconnect the cable, attenuator, and adapter from the generator output and the input connector of the channel last tested.

Check Analog Bandwidth

Equipment required	One sine wave generator (Item 12) One level meter and power sensor (Item 13) One female N to male BNC adapter (Item 16) Four male N to female BNC adapters (Item 15) 50 Ω precision cables BNC (Item 4) SMA (Item 36) Attenuators (Items 1 and 2) One SMA male-to-female BNC adapter (Item 19)
Prerequisites	See page 4-17

1. *Install the test hookup and preset the instrument controls:*

a. *Initialize the instrument:*

- Press **DEFAULT SETUP**.

b. *Modify the default settings:*

- Turn the horizontal **SCALE** knob to 40 ns.
- From the tool bar, touch **Horiz** and select the **Acquisition** tab. Set the acquisition mode as follows:

  TDS7704B: Touch **Sample**.

  All other CSA/TDS7000B: Touch **Average** and set the number of averages to **16**.
- Set the sampling mode as follows:

  TDS7704B: Touch the **Interpolated Real Time IT** button.

  All other CSA/TDS7000B: Touch the **Equivalent Time ET** button.
- From the tool bar, touch **MEAS**. Touch Setup **Ref Levs**; then touch the Method **Min-Max** button.

***NOTE**. The sine wave generator output amplitude must be leveled to within 0.35 db of the reference frequency (10 MHz) through the bandwidth frequency listed in Table 4–7 on page 4–79. The 0.35 db requirement is necessary to ensure a bandwidth that meets Tektronix specifications.*

You can perform bandwidth PV using an unleveled sine wave generator (with amplitude error > 0.35 db). Under these conditions, the bandwidth PV is subject to the flatness errors associated with the generator used.

Refer to the Sine Wave Generator Leveling Procedure *on page 4–137 if your sine wave generator does not have automatic output amplitude leveling.*

c. *Hook up the test-signal source:* Connect the sine wave output of a leveled sine wave generator to **CH 1**. Set the output of the generator to a reference frequency of 10 MHz or less. See Figure 4–15.

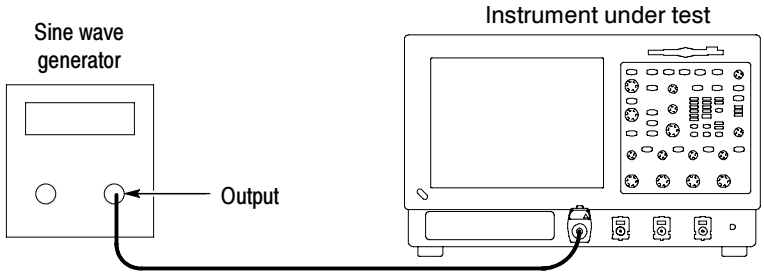

Figure 4-15: Initial test hookup

2. *Confirm the input channels are within limits for analog bandwidth:* Do the following substeps — test CH 1 first, *skipping substeps* a *and b since CH 1 is already set up for testing from step 1*.

a. *Select an unchecked channel:*

- From the tool bar, touch **MEAS** and then **Clear** to remove the previous measurement.
- Press the Vertical button of the channel just confirmed to remove the channel from the display.
- Press the front-panel Vertical button that corresponds to the channel you are to confirm.
- Move the leveled output of the sine wave generator to the channel you selected.

b. *Match the trigger source to the channel selected:* Press the Trigger **SOURCE** button until the source that corresponds to the channel you are to confirm is on.

c. *Set the vertical scale:* Set the vertical **SCALE** that corresponds to the channel you are to confirm to one of the settings listed in Table 4–7 not yet checked. (Start with the 100 mV setting).

d. *Set the triggering coupling:* Touch the Coupling **DC** button.

Table 4-7: Analog bandwidth

Vertical scale	Reference amplitude (6 divisions)	Horizontal scale	Test frequency TDS7704B	Test frequency CSA7404B TDS7404B	Test frequency TDS7254B	Test frequency TDS7154B	Limits -3 dB Limits
2 mV	12 mV	1 ns	1 GHz	1 GHz	1 GHz	1 GHz	≥8.48 mV
5 mV	30 mV	1 ns	1.25 GHz	1.25 GHz	1.25 GHz	1.25 GHz	≥21.2 mV
10 mV	60 mV	1 ns	7 GHz	4 GHz	2.5 GHz	1.5 GHz	≥42.4 mV
20 mV	120 mV	1 ns	7 GHz	4 GHz	2.5 GHz	1.5 GHz	≥84.8 mV
50 mV	300 mV	1 ns	7 GHz	4 GHz	2.5 GHz	1.5 GHz	≥212 mV
100 mV	600 mV	1 ns	7 GHz	4 GHz	2.5 GHz	1.5 GHz	≥424 mV
200 mV	1.2 V	1 ns	7 GHz	4 GHz	2.5 GHz	1.5 GHz	≥848 mV
500 mV	3 V[1]	1 ns	7 GHz	4 GHz	2.5 GHz	1.5 GHz	≥2.12 V[1]
1 V	5 V[1]	1 ns	7 GHz	4 GHz	2.5 GHz	1.5 GHz	≥3.535 V[1]

[1] **If your generator cannot output the required amplitude, determine its maximum output at the Test frequency, and use this for the reference amplitude. The -3 db limit can be calculated as: 0.707 × reference amplitude.**

e. *Display the test signal:* Do the following subparts to first display the reference signal and then the test signal.

- From the button bar touch **MEAS**; then select the **Time** tab.
- Touch the **Freq** button to measure the frequency of the current channel.
- Select the **Ampl** tab. Touch the **Pk-Pk** button.
- Touch the **Statistics** button, then touch the **Mean** button.
- Touch **Close** button.
- Set the generator output so the CHx Pk-Pk mean readout equals the reference amplitude in Table 4–7 that corresponds to the vertical scale set in substep c.

- Set the trigger as follows:

  TDS7704B: Touch the Source **Line** button.

  All other CSA/TDS7000B: Press the front-panel **PUSH TO SET 50%** as necessary to trigger a stable display. At full bandwidth, you may also want to make small, manual adjustments to the trigger level. You can use the **Trigger LEVEL** knob to do this.

f. *Measure the test signal:*

- Set the frequency of the generator, as shown on screen, to the test frequency in Table 4–7 that corresponds to the vertical scale set in substep c. See Figure 4–16.
- Set the horizontal **SCALE** to the horizontal scale setting in Table 4–7 that corresponds to the vertical scale set in substep c. Press **PUSH TO SET 50%** as necessary to trigger the signal.
- Read the results at the CHx Pk-Pk mean readout, which will automatically measure the amplitude of the test signal. See Figure 4–16.

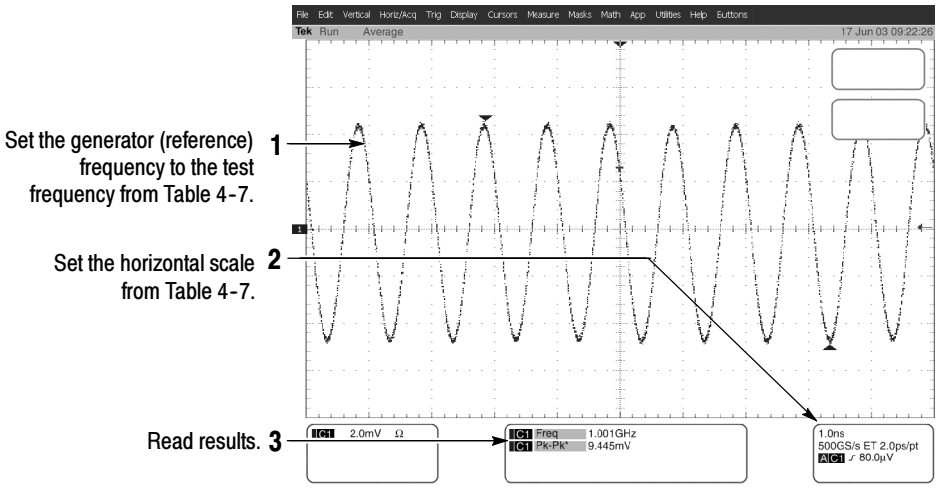

Figure 4-16: Measurement of analog bandwidth

g. *Check against limits:*

- CHECK that the **Pk-Pk** mean readout on screen is within the limits listed in Table 4–7 for the current vertical scale setting.
- Enter the voltage on the test record.

- When finished checking, set the horizontal **SCALE** back to the 40 ns setting.

STOP*. Checking each channel's bandwidth at all vertical scale settings is time consuming and unnecessary. You may skip checking the remaining vertical scale settings in Table 4–7 (that is, skip the following substep, h) if this instrument has performed as follows:*

- Passed the 100 mV vertical scale setting just checked in this procedure.
- Passed the *Verify Internal Adjustment, Self Compensation, and Diagnostics* procedure found under *Self Tests,* on page 4–5.

NOTE*. Passing the signal path compensation confirms the signal path for all vertical scale settings for all channels. Passing the internal diagnostics ensures that the factory-set adjustment constants that control the bandwidth for each vertical scale setting have not changed.*

h. *Check remaining vertical scale settings against limits (optional):*

- If desired, finish checking the remaining vertical scale settings for the channel under test by repeating substeps c through g for each of the remaining scale settings listed in Table 4–7 for the channel under test.
- When doing substep e, skip the subparts that turn on the CHx Pk-Pk mean measurement until you check a new channel.
- Before doing substep f, touch the **Clear** button to remove the previous channel measurements.
- Install/remove attenuators between the generator leveled output and the channel input as needed to obtain the six division reference signals listed in the table.

i. *Test all channels:* Repeat substeps a through g for all four channels.

3. *Disconnect the hookup:* Disconnect the test hook up from the input connector of the channel last tested.

Check Delay Between Channels

Equipment required	One sine wave generator (Item 12) Three precision 50 Ω coaxial cables (Item 4) One power divider (Item 14) 3 SMA female to female adapter connector (Item 17) 3 SMA male-to-female BNC adapter connector (Item 18) Two SMA male-to-female BNC adapter (Item 19)
Prerequisites	See page 4-17

STOP*. DO NOT use the vertical position knob to reposition any channel while doing this check. To do so invalidates the test.*

1. *Install the test hookup and preset the instrument controls:*

   a. *Initialize the front panel:*Press the **DEFAULT SETUP** button.

   b. *Modify the initialized front-panel control settings:*

   - Do *not* adjust the vertical position of any channel during this procedure.
   - Set the horizontal **SCALE** to 500 ps.
   - From the tool bar, touch **Horiz** and select the **Acquisition** tab.
   - Touch **Average** and set the number of averages to **16**.

   c. *Hook up the test-signal source:*

   - Connect the sine wave output of a sine wave generator to a 50 Ω precision coaxial cable followed by a power divider.
   - Connect the power divider to both **CH 1** and **CH 2**. See Figure 4–17.

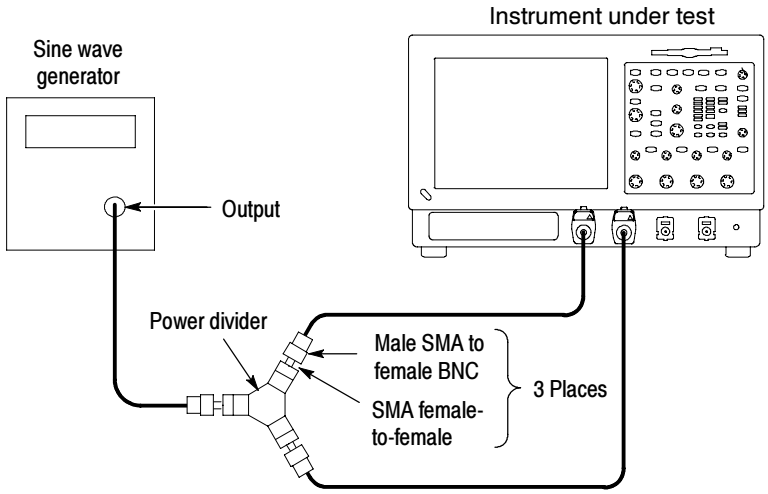

Figure 4-17: Initial test hookup

2. *Confirm all four channels are within limits for channel delay:*

   a. *Set up the generator:* Set the generator frequency to 500 MHz and the amplitude for six to eight divisions in CH 1.

      Hint: As you are adjusting the generator amplitude, push **PUSH TO SET 50%** frequently to speed up the updating of the waveform amplitude on screen.

   b. The horizontal **SCALE** should already be set to 500 ps. Now set it to 100 ps.

   c. *Save a CH 2 waveform:* Press the **CH 2** Vertical button. From the button bar, touch the **Refs** button and select the **Ref 2** tab. Touch the Save Wfm to Ref2 **Save** button.

   d. *Save CH 3 waveform:*

      - Move the power divider from **CH 2** to **CH 3**, so that **CH 1** and **CH 3** are driven. Press the Vertical **CH 2** and **CH 3** buttons. Select the **Ref 3** tab and touch the Ch Channel **3** button. Touch the Save Wfm to Ref3 **Save** button.

   e. *Display all test signals:*

      - Press the **CH 3** Vertical button to remove CH 3 from the display.
      - Display the live waveform. Move the power divider from **CH 3** to **CH 4**, so that CH 1 and CH 4 are driven. Press the Vertical **CH 4** button to display. See Figure 4–18 on page 4–84.

- Display the reference waveforms. To do this, touch the Ref 3 Display **Off** button to toggle it to On and display the reference. Select the **Ref 2** tab and touch the Display **Off** button to toggle it to On. You may notice their overlapping waveform handle icons. See Figure 4–18 on page 4–84.

f. *Measure the test signal:*

- Locate the time reference points for these waveforms. Do this by first identifying the point where the rising edge of the left-most waveform crosses the center horizontal graticule line. Next, note the corresponding *time reference point* for the right-most waveform. See Figure 4–18 on page 4–84.
- Press **CURSORS** and select the **V Bars** Cursors Type.
- Touch the **Close** button.

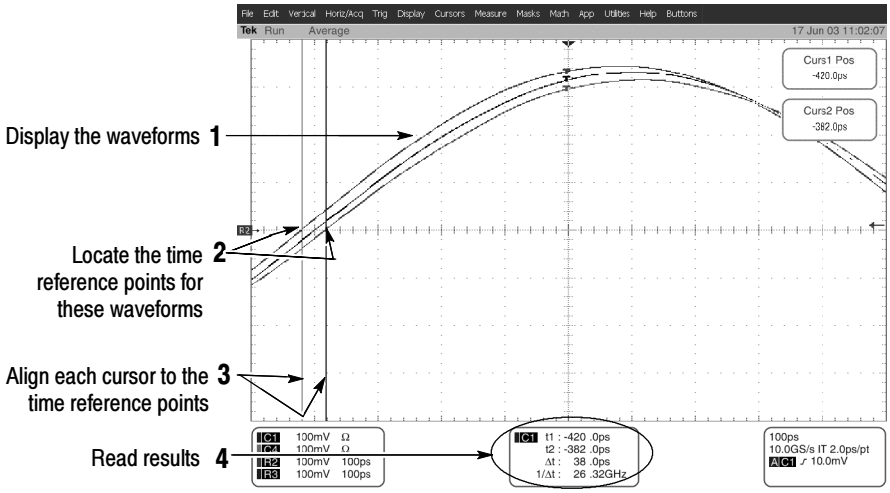

Figure 4-18: Measurement of channel delay

g. *Check against limits:* Use the cursors to measure the skew from CH 1 to CH 2, CH 1 to CH 3, and CH 1 to CH 4. Write down these three numbers in the first measurement column of Table 4–8. Note that these numbers may be either positive or negative.

h. Move the power divider on CH 1 to CH 2. Move the power divider on CH 4 to CH 1.

***NOTE**. To eliminate errors caused by the cables and adapters, the measurements are repeated and averaged after swapping the channel position of the cables.*

i. Repeat the procedure from step 2.a through 2.e.

j. Again use the cursors to measure the skew from CH 1 to CH 2, CH 1 to CH 3, and CH 1 to CH 4. Write down these numbers in the second measurement column of Table 4–8. Note that these numbers may be either positive or negative.

k. Add the first CH 1 to CH 2 skew measurement to the second CH 1 to CH 2 skew measurement and divide the result by 2. Use Table 4–8.

l. Add the first CH 1 to CH 3 skew measurement to the second CH 1 to CH 3 skew measurement and divide the result by 2. Use Table 4–8.

m. Add the first CH 1 to CH 4 skew measurement to the second CH 1 to CH 4 skew measurement and divide the result by 2. Use Table 4–8.

n. Check against limits: CHECK that the largest of the three results from steps k, l, and m is between –30 ps and + 30 ps.

o. Enter the time on the test record.

Table 4-8: Delay between channels worksheet

Coupling	First measurement	Second measurement	Add first and second measurements	Divide sum by 2
CH 1 to CH 2 skew				
CH 1 to CH 3 skew				
CH 1 to CH 4 skew				

3. *Disconnect the hookup:* Disconnect the cable from the generator output at the input connectors of the channels.

Check Channel Isolation (Crosstalk)

Equipment required	One leveled sine-wave generator (Item 12) One 2X attenuator (Item 26) Four TCA-BNC adapters (Item 19) Three 50 Ω terminations (Item 3) One 50 Ω, precision coaxial cable (Item 4)
Prerequisites	See page 4-17

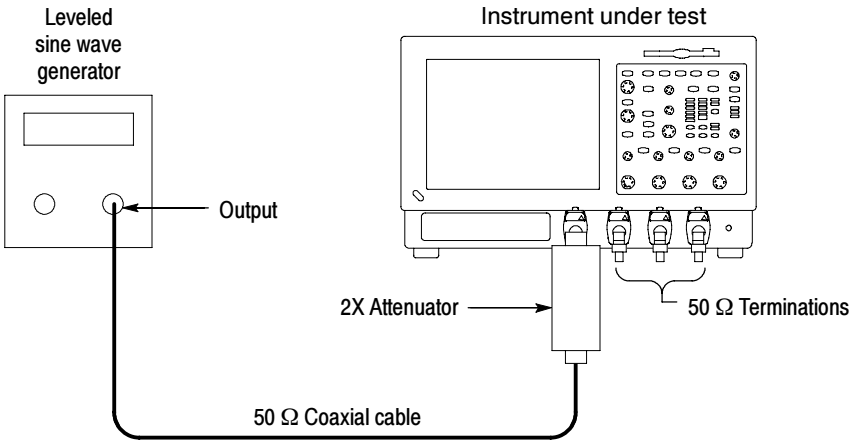

Figure 4-19: Initial test hookup

1. *Install the test hookup and preset the instrument controls:*

   a. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

   b. *Modify the initialized control settings:*

   - Turn on all vertical channels (press the Vertical button of any off channels: CH 1, CH 2, CH 3, and CH 4).
   - Set the Horizontal SCALE to **1 ns**.
   - Set the Vertical SCALE of CH 1, CH 2, CH 3, and CH 4 to **100 mV**.
   - From the tool bar, touch **Horiz** and select the **Acquisition** tab. Set the acquisition mode as follows:

     TDS7704B: Touch **Sample**.

     All other CSA/TDS7000B: Touch **Average**, set the number of averages to **16**.

- Set the sampling mode as follows:

  TDS7704B: Touch the **Interpolated Real Time IT** button.

  All other CSA/TDS7000B: Touch the **Equivalent Time ET** button.

- From the button bar, touch **MEAS**.
- Touch the Source Channel **1** button.
- Select the **Ampl** tab; then touch the **Amplitude** button.
- Touch **Close**.
- Set the Trigger SOURCE to **CH 1**.
- Press **PUSH TO SET 50%**.

c. *Hook up the test-signal source*:

- Connect, through a 50 Ω precision coaxial cable, a 2X attenuator, and a TCA-BNC adapter, the output of the generator to **CH 1** (see Figure 4–19).
- Connect TCA-BNC adapters to the CH 2, CH 3, and CH 4 inputs.
- Connect 50 Ω terminations to the adapters on the CH 2, CH 3, and CH 4 inputs.

2. *Display the test signal:*

- Set the generator to output a sine wave at the bandwidth of your instrument or 1.5 GHz, whichever is less. Set the test signal amplitude for about five divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 500 mV. Readout may fluctuate around 500 mV.
- Remove the 2X attenuator.

3. Confirm the input channels are within limits for channel isolation:

a. Check — Amplitude of each trace other than CH 1 is 0.125 division or less (discount trace width). Enter the largest amplitude on the test record.

b. Move the signal to the **CH 2** input connector, change the Trigger SOURCE to **CH 2**, and move the 50 Ω termination to the CH 1 input.

c. Check — Amplitude of each trace other than CH 2 is 0.125 division or less (discount trace width). Enter the largest amplitude on the test record.

d. Move the signal to the **CH 3** input connector, change the Trigger SOURCE to **CH 3**, and move the 50 Ω termination to the CH 2 input.

e. Check — Amplitude of each trace other than CH 3 is 0.125 division or less (discount trace width). Enter the largest amplitude on the test record.

f. Move the signal to the **CH 4** input connector, change the Trigger SOURCE to **CH 4**, and move the 50 Ω termination to the CH 3 input.

g. Check — Amplitude of each trace other than CH 4 is 0.125 division or less (discount trace width). Enter the largest amplitude on the test record.

h. Select an unchecked vertical SCALE:

- Connect the 2X attenuator to the CH 1 input.
- Move the signal to the CH1 input, change the Trigger Source to **CH 1**, and move the 50 Ω termination to the CH 4 input.
- Press **PUSH TO SET 50%**.
- Set the Vertical SCALE of CH 1, CH 2, CH 3, and CH 4 to **50 mV**
- Set the test signal amplitude for about five divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 250 mV. Readout may fluctuate around 250 mV.
- Remove the 2X attenuator.
- Repeat substeps a through g.
- Connect the 2X attenuator to CH 1.
- Move the signal to the CH 1 input, change the Trigger Source to **CH 1**, and move the 50 Ω termination to the CH 4 input.
- Press **PUSH TO SET 50%**.
- Set the Vertical SCALE of CH 1, CH 2, CH 3, and CH 4 to **10 mV**
- Set the test signal amplitude for about five divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 50 mV. Readout may fluctuate around 50 mV.
- Remove the 2X attenuator.
- Repeat substeps a through g.

4. *Display the test signal:* If your instrument bandwidth is ≤1.5 GHz, skip to step 6.

- Connect the 2X attenuator to CH 1.

- Move the signal to the CH 1 input, change the Trigger Source to **CH 1**, and move the 50 Ω termination to the CH 4 input.
- Press **PUSH TO SET 50%**.
- Set the Vertical SCALE of CH 1, CH 2, CH 3, and CH 4 to **100 mV**.
- Set the Horizontal SCALE to display 2 to 5 cycles of the signal.
- Set the generator to output a sine wave at the bandwidth of your instrument. Set the test signal amplitude for about five divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 500 mV. Readout may fluctuate around 500 mV.
- Set the trigger as follows:

  TDS7704B: Touch the Source **Line** button.

  All other CSA/TDS7000B: Press the front-panel **PUSH TO SET 50%** as necessary to trigger a stable display. At full bandwidth, you may also want to make small, manual adjustments to the trigger level. You can use the **Trigger LEVEL** knob to do this.
- Remove the 2X attenuator.

5. Confirm the input channels are within limits for channel isolation:

a. Check — Amplitude of each trace other than CH 1 is 0.67 division or less (discount trace width). Enter the largest amplitude on the test record.

b. Move the signal to the CH 2 input connector, change the Trigger SOURCE to CH 2, and move the 50 Ω termination to the CH 1 input.

c. Check — Amplitude of each trace other than CH 2 is 0.67 division or less (discount trace width). Enter the largest amplitude on the test record.

d. Move the signal to the CH 3 input connector, change the Trigger SOURCE to CH 3, and move the 50 Ω termination to the CH 2 input.

e. Check — Amplitude of each trace other than CH 3 is 0.67 division or less (discount trace width). Enter the largest amplitude on the test record.

f. Move the signal to the CH 4 input connector, change the Trigger SOURCE to CH 4, and move the 50 Ω termination to the CH 3 input.

g. Check — Amplitude of each trace other than CH 4 is 0.67 division or less (discount trace width). Enter the largest amplitude on the test record.

h. Select an unchecked Vertical SCALE:

- Connect the 2X attenuator to CH 1.

- Move the signal to CH 1, set the Trigger SOURCE to CH 1, and move the 50 Ω termination to the CH 4 input.
- Press **PUSH TO SET 50%**.
- Set the Vertical SCALE of CH 1, CH 2, CH 3, and CH 4 to **50 mV**
- Set the test signal amplitude for about five divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 250 mV. Readout may fluctuate around 250 mV.
- Remove the 2X attenuator.
- Repeat substeps a through g.
- Connect the 2X attenuator to CH 1.
- Move the coaxial cable to CH 1, set the Trigger SOURCE to CH 1, and move the 50 Ω termination to the CH 4 input.
- Set the Vertical SCALE of CH 1, CH 2, CH 3, and CH 4 to **10 mV**
- Set the test signal amplitude for about five divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 50 mV. Readout may fluctuate around 50 mV.
- Remove the 2X attenuator.
- Repeat substeps a through g.

6. *Disconnect the hookup:* Disconnect the cable, terminations, and adapters from the generator output and the input connector of the channel.

Check Input Impedance

Equipment required	One Digital Multimeter (Item 27) One Dual-Banana Connector, (Item 5) One precision 50 Ω coaxial cable (Item 4) One SMA male-to-female BNC adapter (Item 19)
Prerequisites	See page 4-17

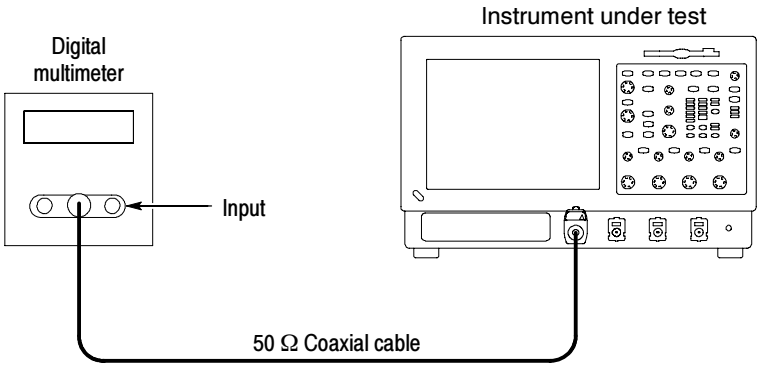

Figure 4-20: Initial test hookup

1. *Install the test hookup and preset the instrument controls:*
   - **a.** *Initialize the instrument:* Press the **DEFAULT SETUP** button.
   - **b.** *Hook up the test-signal source*: Connect, through a 50 Ω precision coaxial cable, the input of the multimeter to **CH 1** through adapters (see Figure 4–20).
   - **c.** Set the Vertical **SCALE** to **10 mV** per division
2. *Check input impedance against limits:*
   - **a.** *Measure the impedance:*Read and record the measured impedance.
   - **b.** Remove the dual banana connector from the digital multimeter (DMM), turn it 180 degrees and reinsert it in the DMM input.
   - **c.** *Measure the impedance:*Read and record the measured impedance.
   - **d.** Add the two measurements and divide the result by 2.
   - **e.** Check — Average of the two measurements is ≥48.75 Ω and ≤51.25 Ω. Enter average on the test record.
3. Set the Vertical **SCALE** to **100 mV** per division and repeat step 2.
4. *Repeat steps 2 through 3 for the remaining input channels:*
   - **a.** Move the test setup to an unchecked input channel.
   - **b.** Set the Vertical **SCALE** of the channel to **10 mV** per division.
   - **c.** Repeat steps 2 *through 3*.
5. *Disconnect the hookup:* Disconnect the equipment from the instrument.

Time Base System Checks

These procedures check those characteristics that relate to the time base system and are listed as checked under *Warranted Characteristics* in *Specifications.*

Check Long-Term Sample Rate and Delay Time Accuracy and Reference

Equipment required	One timer-counter (Item 11) One 50 Ω, precision coaxial cable (Item 4) One SMA male-to-female BNC adapter (Item 19) One sine wave generator (Item 12)
Prerequisites	See page 4-17

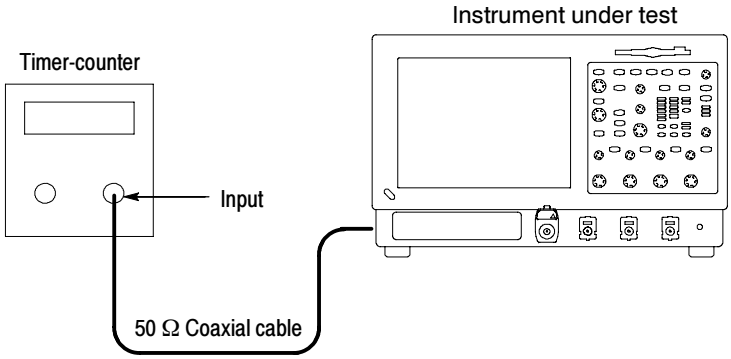

Figure 4-21: Initial test hookup

1. *Install the test hookup and preset the instrument controls:*
   - **a.** *Hook up the test-signal source*: Connect, through a 50 Ω precision coaxial cable, the input of the timer-counter to **REF OUT** (see Figure 4-21).
     - Set the timer-counter gate to 1 s.
     - Set the timer-counter to count the reference output.
   - **b.** *Initialize the instrument:* Press the **DEFAULT SETUP** button.
2. *Confirm the time base is within limits for accuracies:*
   - **a.** *Check long-term sample rate and delay time accuracies against limits:*
     - CHECK that the count on the timer-counter is within limits.

- Enter the count on the test record.

3. *Confirm reference is within limits for logic levels:*

   a. *Display the test signal:*

      - Move the cable from the timer-counter to the CH 1 input through an adapter.
      - Set the Vertical **SCALE** to 1 V.
      - Use the Vertical **POSITION** knob to center the display on screen.

   b. *Measure logic levels:*

      - From the button bar, touch **MEAS** and select the **Ampl** tab.
      - Touch the **High** and **Low** buttons.
      - Touch the **Close** button.

   c. *Check REF OUT output against limits:* CHECK that the **CH 1 High** readout is ≥1.0 volt and that the **CH 1 Low** readout ≤0.25 volts.

4. *Disconnect the hookup:* Disconnect the cable and adapter from the instrument.

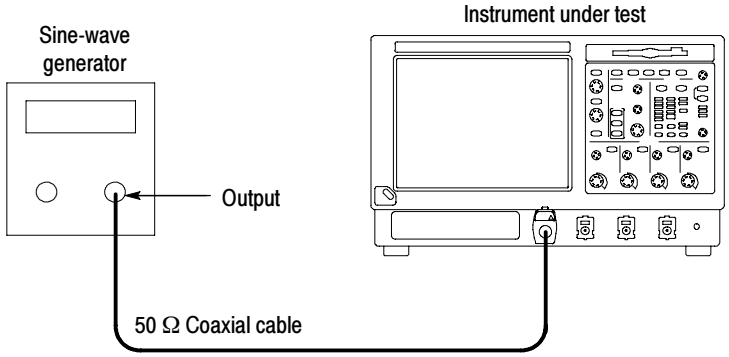

Figure 4-22: Initial test hookup

5. *Install the test hookup and preset the instrument controls:*

   a. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

   b. *Hook up the test-signal source*: Connect, through a 50 Ω precision coaxial cable, the output of the sine wave generator to **CH 1** input through an adapter (see Figure 4–22).

      - From the button bar, touch **MEAS** and select the **Ampl** tab.

- Touch the **Pk-Pk** button.
- Touch the **Close** button.
- Set the Vertical **SCALE** to 50 mV.
- Set the generator for a 10.0 MHz sine wave.
- Set the generator to output a 4 division signal. Adjust the output until the Pk-Pk readout displays 200 mV.

c. *Set the instrument controls:*

- Move the cable from the **CH 1** input to the rear-panel **Ext Ref** input (see Figure 4–23).
- Touch **Menu** to select menu mode.
- Touch **Utilities** and select **External Signals**.
- Touch the **Internal** button to select the external reference (the button name changes to External).

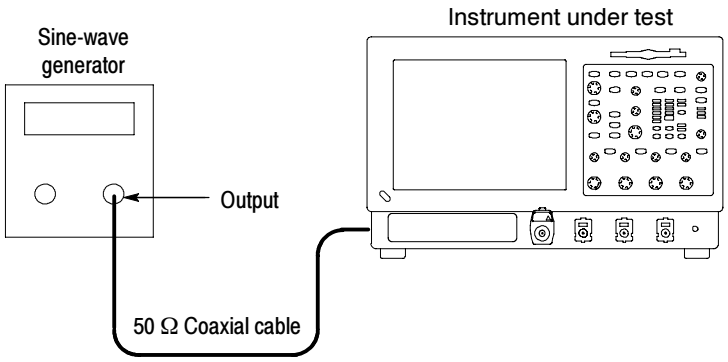

Figure 4- 23: Final test hookup

6. *Confirm external reference:*

a. *Perform a signal path compensation:*

- Touch **Utilities** and select **Instrument Calibration**.
- Touch **Calibrate** and wait for the signal path compensation to finish.

b. *Check the completion status:* If the Status is Fail, refer the instrument to qualified service personnel.

7. *Disconnect the hookup:*

   a. Disconnect all test equipment from the instrument.

   b. *Set the instrument controls:*

      - From menu mode, touch **Utilities** and select **External Signals**.
      - Touch the **External** button to select the internal reference (the button name changes to Internal).

   c. *Perform a signal path compensation:*

      - Touch **Utilities** and select **Instrument Calibration**.
      - Touch **Calibrate** and wait for the signal path compensation to finish.

Check Delta Time Measurement Accuracy

Equipment required	One 50 Ω, precision coaxial cable (Item 4) One Connector, BNC "T", male BNC-to-dual female BNC (Item 6) One Pulse Generator, Wavetek 9500 or equivalent (Item 20) Two 50 Ω, coaxial cable, male-to-male SMA connectors (Item 21) One SMA female to BNC male connector (Item 23) One BNC elbow connector (Item 24) One SMA "T", male to two SMA female connectors (Item 22) Two SMA termination connectors, short circuit, (Item 25) One SMA male-to-female BNC adapter (Item 19) One 2X attenuator, 50 Ω, female BNC-to-male BNC (Item 26)
Prerequisites	See page 4-17

This procedure checks the "sample rate" portion of the Delta Time Measurement Accuracy as listed in *Specifications.* The previous procedure, *Check Long-Term Sample Rate and Delay Time Accuracy and Reference*, see page 4–92, verified the "PPM" portion of the delta time specification.

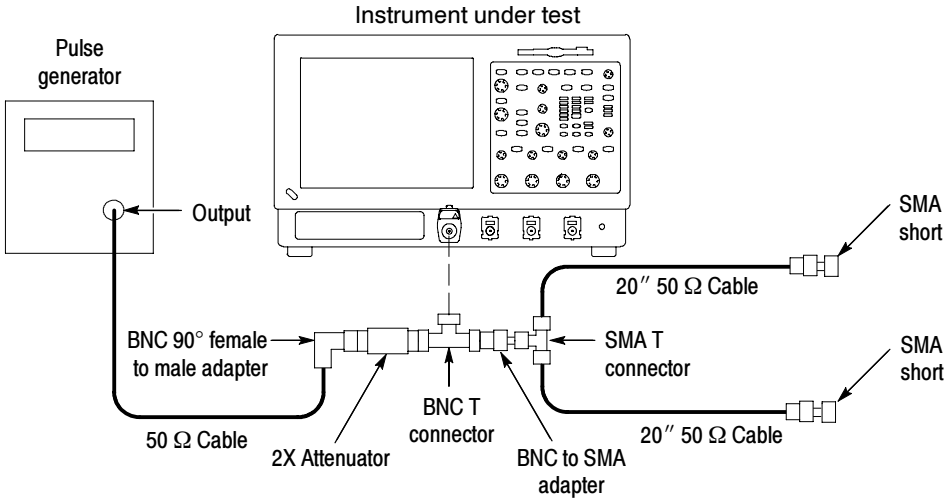

Figure 4-24: Delta time accuracy test hookup

1. *Install the test hookup and preset the instrument controls:*

   a. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

   b. *Hook up the pulse generator (see Figure 4-24 on page 4-96):*

   - Connect the pulse generator output to a **50 Ω** precision coaxial cable followed by a 90° right-angle female to male BNC adapter, then a **50 Ω** 2X attenuator. The attenuator is connected to one side of the female BNC T connector. The other side of the BNC T is connected to BNC male to SMA adapter. The SMA side is connected to the male side of the SMA T connector. (Keep the distance between the BNC T and SMA T as short as possible). Connect 20 inch **50 Ω** coaxial cables to each female side of the SMA T connector. Connect the SMA short, to the remaining female SMA connector. Now connect the male BNC T connector to **CH 1**.
   - Set the pulse generator output for a positive-going pulse with a rise-time as shown in Table 4-9 on page 4-98 for your instrument, and for the fastest possible rep rate (at least 1 kHz).
   - Set the pulse generator output for about 500 mV. (This amplitude can be adjusted later to get a 6-division pulse on screen.)

   c. *Modify the initialized front-panel control settings:*

   - Power on the pulse generator.
   - Press **AUTOSET**. You may see both positive and negative pulses. Adjust the Trigger **LEVEL** knob so the trigger level is about 50% of the rising edge of the positive pulse.

- From the button bar, touch the **Horiz** button and select the **Acquisition** tab. Press the **RT** button to turn on Real Time Only.
- Set the horizontal SCALE to 5 ns/division. The pulse width should be about **6 ns**. The indicated sample rate should be 20 GS/s
- Set the vertical scale to 20 mV/div. Adjust the vertical Offset and generator output level as necessary to obtain at least **6 divisions** of the **positive** pulse.

***NOTE**. If you have followed the procedure, you should have a 120 mV pulse displayed on screen. Later in this procedure you will set the instrument to measure the pulse width at the 75 mV level.*

If the pulse you supply to the instrument is not a 120 mV pulse, you may need to set the reference level (MidRef) to something other than 75 mV. Set the reference level near the center of the pulse, above any noise, and below any overshoot or ringing on the pulse.

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d. *Set up for statistics measurements:*

- Press **RUN/STOP** button to freeze the display.
- From the Button bar, touch **MEAS** and select the **Time** tab to bring up the Time Measurements menu.
- Touch the **Positive Width** button.
- Touch Setup **Statistics**. Touch the Measurement Statistics **All** button and then touch **Reset** to reset the statistics.
- Touch **Weight n=**. On the keypad press **1000**, then **ENTER**. Touch **Setup**.
- Touch Setup **Ref Levs** and then touch **Absolute**.
- Touch **MidRef**. Using the keypad or multipurpose knobs, set the mid reference to **75 mV** and press Enter. Touch **Close**.
- Press the **RUN/STOP** button to start the acquisitions.
- Wait about 30 seconds.
- Press **RUN/STOP** button to freeze the display.
- Record the all statistics values.
- Calculate the difference of the Maximum (M) minus the mean (μ).
- Calculate the difference of the mean (μ) minus the Minimum (m).

- Both differences must be less than or equal to the Delta-time accuracy limit shown in Table 4–9 for your instrument.
- Enter the result for delta time on the test record.

Table 4-9: Delta time measurement

Instrument type	Pulse generator rise time range	Delta time accuracy limit
CSA7404B	140 ps - 400 ps	≤ 0.030 ns
TDS7704B, CSA7404B, or TDS7404B	≤ 150 ps	≤ 0.015 ns
TDS7254B	160 ps to 200 ps	≤ 0.015 ns
TDS7154B	160 ps to 240 ps	≤ 0.015 ns

e. *Repeat for all other channels:*

- Note the vertical scale setting of the channel just confirmed.
- Press the Vertical channel button for the channel just confirmed to remove the channel from display.
- Touch **MEAS** and the **Clear** to remove the measurement.
- Press the front-panel button that corresponds to the channel you are to confirm.
- Set vertical SCALE to the setting noted in step e, first bullet.
- Press the Trigger Source button to toggle the source to the channel selected.
- Move the test hookup to the channel you selected.
- Press **RUN/STOP** button to start the display.
- Repeat step d.

2. *Disconnect all test equipment from the instrument.*

Trigger System Checks

These procedures check those characteristics that relate to the trigger system and are listed as checked in *Specifications.*

Check Time Accuracy for Pulse, Glitch, Timeout, and Width Triggering

Equipment required	One sine wave generator (Item 12) One 2X attenuator (Item 26) One 50 Ω, precision coaxial cable (Item 4) One SMA male-to-female BNC adapter (Item 19)
Prerequisites	See page 4-17

1. *Install the test hookup and preset the instrument controls:*

   a. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

   b. *Modify the default setup:* Set the horizontal **SCALE** to 2.5 ns.

   c. *Hook up the test-signal source:* Connect the output of the sine wave generator (Item 12) to CH 1.

      Do this through a 50 Ω precision coaxial cable, followed by a 2X attenuator and adapter. See Figure 4–25.

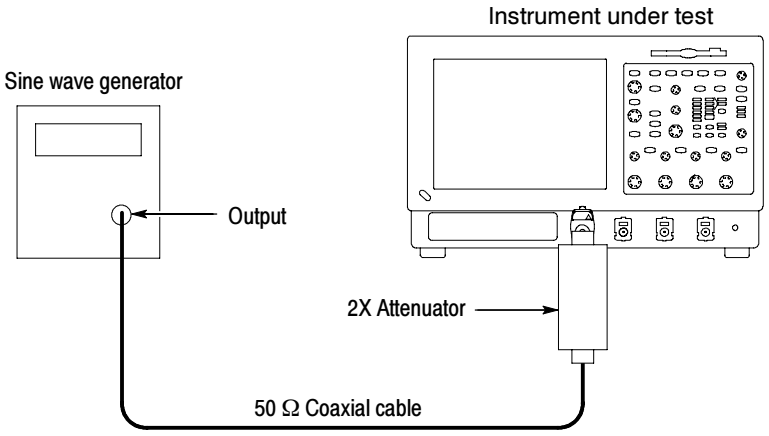


Figure 4-25: Initial test hookup

   d. *Set the trigger mode:* Press the Trigger **MODE** button to toggle it to **NORMAL**.

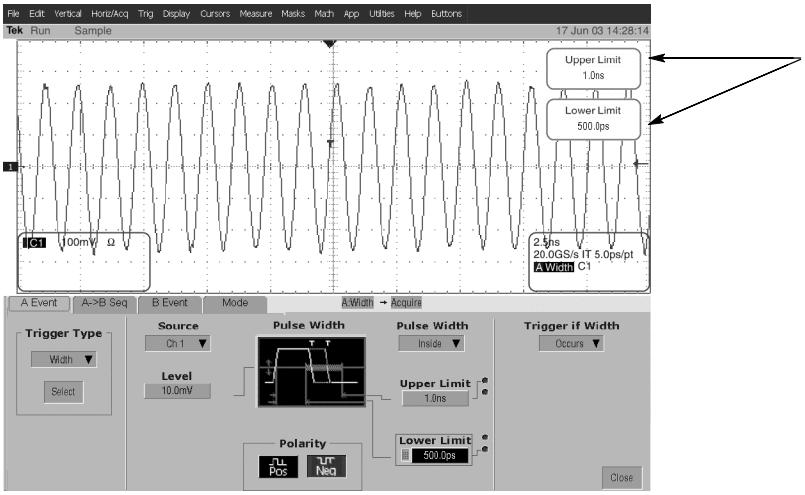


Figure 4-26: Measurement of time accuracy for pulse and glitch triggering

2. *Confirm the trigger system is within time-accuracy limits for pulse-glitch or pulse-width triggering (1 ns < time range >1 µs):*

   a. *Set upper and lower limits that ensure triggering at 100 MHz:* See Figure 4–26.

   - Press the front-panel **ADVANCED** button and select the **A Event** tab; then pull down on Trigger Type and select **width** triggering.
   - Pull down Pulse Width and select **Inside** limits.
   - Touch **Upper Limit**. Use the keyboard to set the upper limit to 10 ns.
   - Touch **Lower Limit**. Use the keypad to set the lower limit to 2 ns.

   b. *Display the test signal:*

   - Set the Horizontal **SCALE** to 20 ns.
   - Set the output of the sine wave generator for a 100 MHz, five-division sine wave on screen. Set the Vertical **SCALE** to 20 mV (the waveform will overdrive the display).
   - Press **PUSH TO SET LEVEL 50%**.

   c. *Check against limits:* Do the following subparts in the order listed.

   - While doing the following subparts, monitor the display (it will stop acquiring) and the front-panel light **TRIG'D** (it will extinguish) to determine when triggering is lost.

- Use the multipurpose knob to *increase* the **Lower Limit** readout until triggering is lost.
- CHECK that the **Lower Limit** readout, after the instrument stops triggering, is within 4.75 ns to 5.25 ns, inclusive.
- Enter the time on the test record.
- Use the keypad to return the **Lower Limit** to 2 ns and reestablish triggering.
- Touch **Upper Limit**; then use the multipurpose knob to slowly *decrease* the **Upper Limit** readout until triggering stops.
- CHECK that the **Upper Limit** readout, after the instrument loses triggering, is within 4.75 ns to 5.25 ns, inclusive.
- Enter the time on the test record.

3. *Disconnect the hookup:* Disconnect the cable and adapter from the generator output and the input connector of **CH 1**.

Check Sensitivity, Edge Trigger, DC Coupled

Equipment required	One sine wave generator (Item 12) Two precision 50 Ω coaxial cables (Item 4) One 10X attenuator (Item 1) One BNC T connector (Item 6) One SMA male-to-female BNC adapter (Item 19) One 5X attenuator (Item 2)
Prerequisites	See page 4-17.

1. *Install the test hookup and preset the instrument controls:*
   a. *Initialize the instrument:* Press the **DEFAULT SETUP** button.
   b. *Modify the initialized front-panel control settings:*
      - Set the Horizontal **SCALE** to 20 ns.
      - Press the Trigger **MODE** button to toggle it to **Normal**.
      - From the tool bar, touch **Horiz** and select the **Acquisition** tab.
      - Touch **Average** and set the number of averages to **16**.
      - Touch the **Equivalent Time ET** button.

c. *Hook up the test-signal source:*

- Connect the signal output of the generator to a BNC T connector. Connect one output of the T connector to **CH 1** through a 50 Ω precision coaxial cable and an adapter. Connect the other output of the T connector to the **AUX INPUT** through a 50 Ω precision coaxial cable. See Figure 4–27.

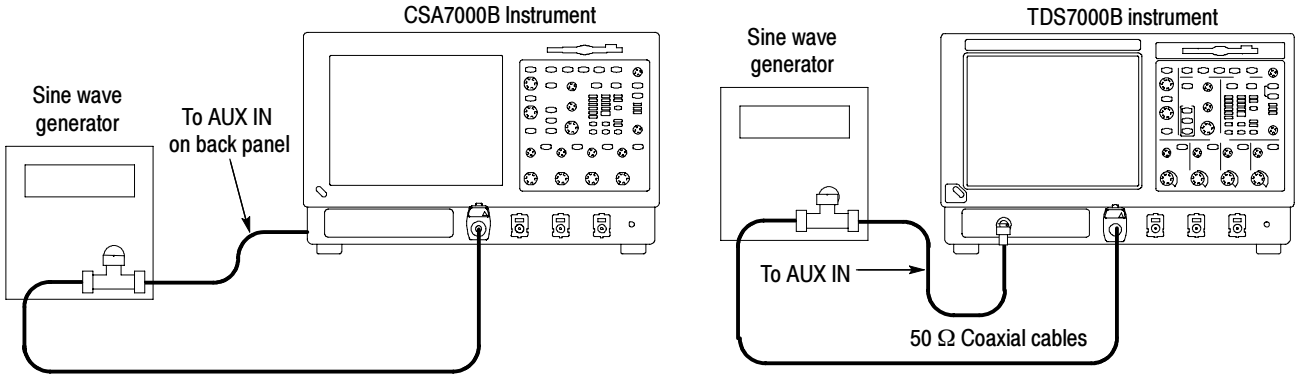


Figure 4-27: Initial test hookup

2. *Confirm the trigger system is within sensitivity limits (50 MHz):*

a. *Display the test signal:*

- Set the generator frequency to 50 MHz.
- From the button bar, touch **MEAS**.
- Touch Setup **Ref Levs**; then touch the **Min-Max** button.
- Touch the **Setup** button and select the **Ampl** tab; then touch the **Amplitude** button.
- Touch **Close**.
- Press **PUSH TO SET 50%**.
- Set the test signal amplitude for about five divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 500 mV. Readout may fluctuate around 500 mV.
- Disconnect the 50 Ω precision coaxial cable at **CH 1** and reconnect it to **CH 1** through a 10X attenuator.

b. *Check the Main trigger system for stable triggering at limits:*

- Read the following definition: A stable trigger is one that is consistent; that is, one that results in a uniform, regular display triggered on the selected slope (positive or negative). This display should *not* have its trigger point switching between opposite slopes, nor should it roll across the screen. At horizontal scale settings of 2 ms/division and faster, **TRIG'D** will remain constantly lighted. It will flash for slower settings.
- Press the Trigger **Slope** button to select the positive slope.
- Adjust the Trigger **LEVEL** knob so that there is a stable trigger. CHECK that the trigger is stable for the test waveform on the positive slope.
- Press the Trigger **Slope** button to select the negative slope. Adjust the Trigger **LEVEL** knob so that there is a stable trigger.
- CHECK that the trigger is stable for the test waveform on the negative slope.
- Leave the trigger system triggered on the positive slope of the waveform before continuing to the next step.

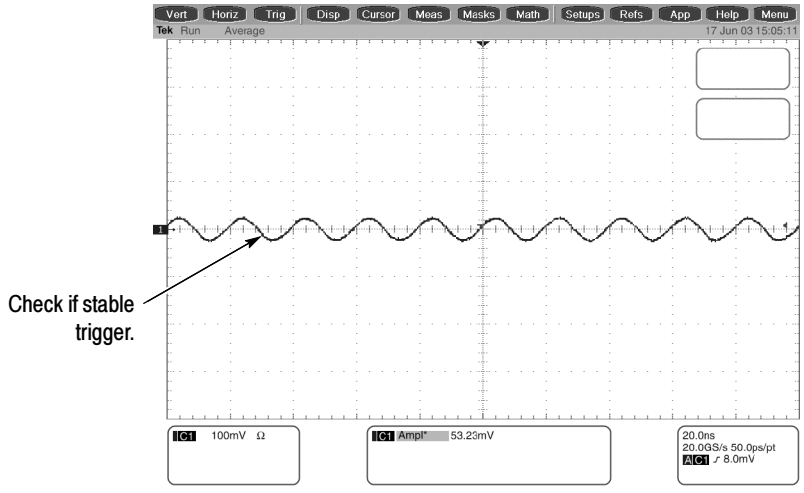


Figure 4-28: Measurement of trigger sensitivity - 50 MHz results shown

c. *Check Delayed trigger system for stable triggering at limits:* Do the following subparts in the order listed.

- From the button bar touch **Trig**, select the **A Event** tab, and set the **Source** to Line.

- From the button bar touch **Trig**, select the **A->B Seq** tab, and touch the A then B **Trig After Time** button.
- Select the **B Event** tab, and touch the **Set 50%** button.
- CHECK that a stable trigger is obtained for the test waveform for both the positive and negative slopes of the waveform. Use the **TRIGGER LEVEL** knob to stabilize the Main trigger. Touch **B Trig Level** and use the keypad or the multipurpose knob/FINE button to stabilize the Delayed trigger. Touch one of the Slope buttons to switch between trigger slopes. See Figure 4–28 on page 4–103.
- Leave the Delayed trigger system triggered on the positive slope of the waveform before continuing to the next step. Also, return to the main trigger: select the **A->B Seq** tab and touch the A->B Sequence **A Only** button. Then select the **A Event** tab.
- Press **Close**.

3. *Confirm the AUX Trigger input (at 50 MHz):*

a. *Display the test signal:*

- Remove the 10X attenuator and reconnect the cable to **CH 1**.
- Set the signal amplitude as follows:

CSA7404B	**2.5 divisions**
TDS7704B, CSA7404B, TDS7404B, TDS7254B & TDS7154B	**1.5 divisions**

- Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is as follows (Readout may fluctuate):

CSA7404B	**250 mV**
TDS7704B, CSA7404B, TDS7404B, TDS7254B & TDS7154B	**150 mV**

b. *Check the AUX trigger source for stable triggering at limits:* Do the following in the order listed.

- Use the definition for stable trigger from step 2b.
- Press the Trigger **SOURCE** button to toggle it to **EXT**.
- Press **PUSH TO SET 50%**.
- CHECK that a stable trigger is obtained for the test waveform on both the positive and negative slopes. Press the Trigger **SLOPE**

button to switch between trigger slopes. Use the Trigger **LEVEL** knob to stabilize the trigger if required.

- Leave the trigger system triggered on the positive slope of the waveform before proceeding to the next check.
- Press the Trigger **SOURCE** button to toggle it to **CH 1**.

4. *Confirm that the trigger system is within sensitivity limits (full bandwidth):*

a. *Set the Horizontal Scale:* Set the Horizontal **SCALE** to 200 ps.

b. *Display the test signal:*

- Set the generator frequency to full bandwidth as follows:

CSA7404B	**3 GHz**
TDS7704B	**3 GHz**
CSA7404B	**3 GHz**
TDS7404B	**3 GHz**
TDS7254B	**2.5 GHz**
TDS7154B	**1.5 GHz**

- Set the generator amplitude on screen as follows:

TDS7704B	**7 divisions**
CSA7404B	**7 divisions**
TDS7404B	**7 divisions**
TDS7254B	**5 divisions**
TDS7154B	**5 divisions**

- Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is as follows (Readout may fluctuate):

TDS7704B	**750 mV**
CSA7404B	**750 mV**
TDS7404B	**750 mV**
TDS7254B	**500 mV**
TDS7154B	**500 mV**

- Disconnect the cable at **CH 1** and reconnect it to **CH 1** through a 5X attenuator. Check that a stable trigger is obtained.

c. Repeat step 2, substep b for the full bandwidth selected.

d. *Display the test signal (delay trigger at 1.5 GHz):*

- Set the generator frequency as follows:

CSA7404B	**1.5 GHz**

TDS7704B, CSA7404B, TDS7404B, TDS7254B & TDS7154B	**1.5 GHz**

- Disconnect the 5X attenuator. Set the test signal amplitude for about five divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 500 mV. (Readout may fluctuate around 500 mV).
- Disconnect the cable at **CH 1** and reconnect it to **CH 1** through a 5X attenuator. Check that a stable trigger is obtained.

e. Repeat step 2, substep c only, for the bandwidth selected.

f. *Display the test signal (Aux trigger at 2 GHz):*

- Set the generator frequency to 2 GHz.
- Set the Horizontal SCALE to 200 ps.
- Remove the 5X attenuator and reconnect the cable to **CH 1**.
- Set the generator amplitude on screen as follows:

CSA7404B	**4 divisions**
TDS7704B, CSA7404B, TDS7404B, TDS7254B & TDS7154B	**5 divisions**

- Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is as follows (Readout may fluctuate):

CSA7404B	**350 mV**
TDS7704B, CSA7404B, TDS7404B, TDS7254B & TDS7154B	**500 mV**

g. Repeat step 3, substeps b only, for the full bandwidth selected.

NOTE*. You just checked the trigger sensitivity. If desired, you may repeat steps 1 through 4c for the other channels (CH 2, CH 3, and CH 4).*

5. *Disconnect the hookup:* Disconnect the cables and adapter from AUX IN and the channel last tested.

Output Signal Checks

The procedure that follows checks those characteristics of the output signals that are listed as checked under *Warranted Characteristics* in *Specifications.*

Check Outputs — CH 3 Signal Out and Aux Trigger Out

Equipment required	Two precision 50 Ω coaxial cables (Item 4) One calibration generator (Item 10) Two SMA male-to-female BNC adapter (Item 19)
Prerequisites	See page 4-17. Also, the instrument must have passed *Check DC Voltage Measurement Accuracy* on page 4-45.

1. *Install the test hookup and preset the instrument controls:*

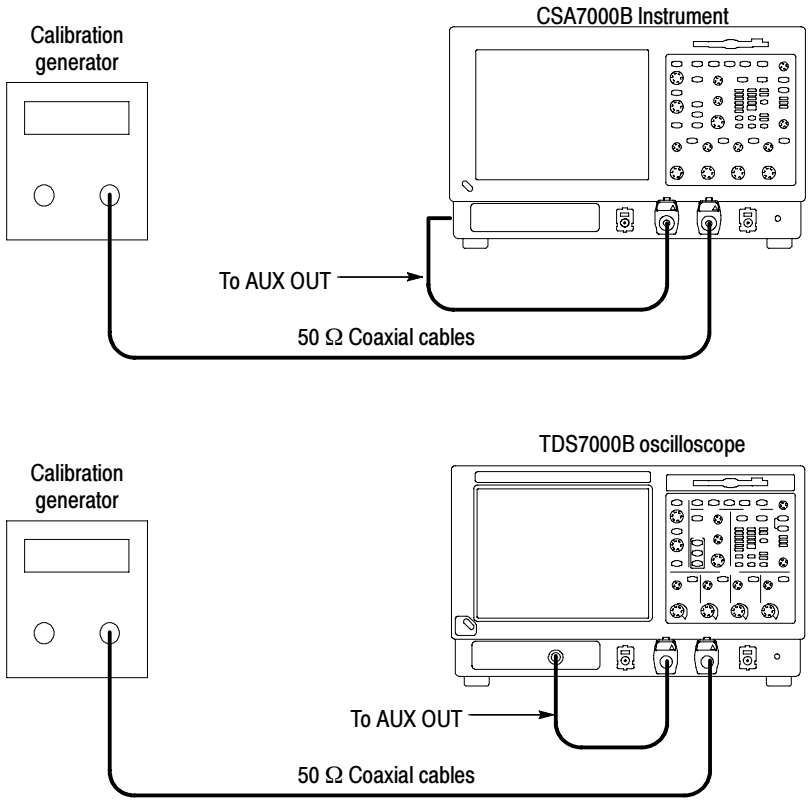


Figure 4-29: Initial test hookup

a. *Hook up test-signal source 1 (See Figure 4-29):*

- Connect the standard amplitude output of a calibration generator through a 50 Ω precision coaxial cable to **CH 3** through an adapter.
- Set the calibration generator to output a 0.500 V square wave.

b. *Hook up test-signal source 2:* Connect the **Aux Out** to **CH 2** through a 50 Ω precision cable and an adapter.

c. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

d. *Modify the initialized front-panel control settings:*

- Press the Vertical **CH 1** button to toggle it off.
- Press the Vertical **CH 3** button to display that channel.
- Push Trigger **Source** to toggle the source to **CH 3**.
- Set the Horizontal **SCALE** to 200 µs.
- If necessary, adjust the calibration generator output for 5 divisions of amplitude.
- From the tool bar, touch **Horiz** and select the **Acquisition** tab.
- Touch **Average** and set the number of averages to **64**.
- Touch the **Close** button.

2. *Confirm AUX OUT is within limits for logic levels:*

a. *Display the test signal:*

- Press the Vertical **CH 3** button to turn off CH 3.
- Press the Vertical **CH 2** button to display that channel.
- Set the Vertical **SCALE** to 500 mV.
- Use the Vertical **POSITION** knob to center the display on screen.

b. *Measure logic levels:*

- From the button bar, touch **MEAS** and select the **Ampl** tab.
- Touch the **High** and **Low** buttons.
- Touch the **Close** button.

c. *Check AUX OUT output against limits:* CHECK that the **CH 2 High** readout is ≥1.0 volt and that the **CH 2 Low** readout ≤0.25 volts. See Figure 4–30.

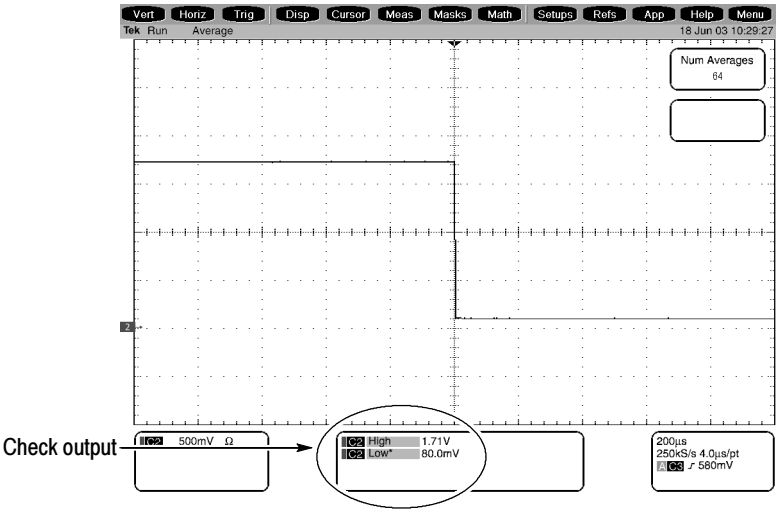


Figure 4- 30: Measurement of trigger out limits

3. *Confirm SIGNAL OUT is within limits for gain:*

   a. *Measure gain:*

      - Move the precision 50 Ω cable from the **AUX OUT** BNC to the **SIGNAL OUT** BNC.
      - Set Vertical **SCALE** to 50 mV.
      - Press **PUSH TO SET 50%**.
      - From the button bar, touch **MEAS** and select the **Ampl** tab.
      - Touch the **Pk-Pk** button.
      - Touch **Close**.

   b. *Check against limits:* CHECK that the readout **CH 2 Pk-Pk** is between 40 mV and 60 mV, inclusive.

4. *Confirm SIGNAL OUT is within limits for offset:*

      - Disconnect the cable from the CH 3 input.
      - From the button bar, touch **MEAS** and select the **Ampl** tab.
      - Touch the **Low** button.
      - Touch **Close**.

   a. *Check against limits:* CHECK that the Low reading is between –100 mV and –170 mV, inclusive.

5. *Disconnect the hookup:* Disconnect the cables and adapters from the inputs and outputs.

Check Probe Compensation Output

Equipment required	Two dual-banana connectors (Item 5) One BNC T connector (Item 6) Two precision 50 Ω coaxial cables (Item 4) One DC calibration generator (Item 9) One SMA-to-BNC adapter (Item 19)
Prerequisites	See page 4-17. Also, the instrument must have passed *Check Accuracy For Long-Term Sample Rate and Delay Time Accuracy and Reference* on page 4-92.

1. *Install the test hookup and preset the instrument controls:*

   a. *Hook up test-signal:*

   - Connect one of the 50 Ω cables to **CH 1** through an adapter. See Figure 4-31.
   - Connect the other end of the cable just installed to the **PROBE COMPENSATION** output. See Figure 4-31.

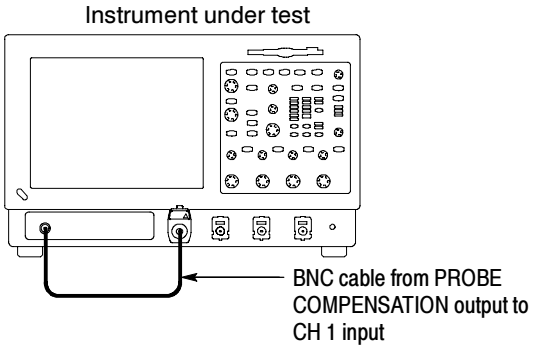


Figure 4-31: Initial test hookup

   b. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

   c. *Modify the initialized front-panel control settings:*

   - Set the **Vertical SCALE** to 100 mV.

- From the tool bar, touch the **Vert** button and then touch **Offset**. Adjust the Ch1 Offset to –0.25 V using the multipurpose knob.
- Set the Horizontal **SCALE** to 200 µs.
- Press **PUSH TO SET 50%**.
- Use the Vertical **POSITION** knob to center the display on screen.
- From the tool bar, touch **Horiz** and select the **Acquisition** tab.
- Touch **Average** and set the number of averages to **128**.

2. *Confirm that the Probe Compensator signal is within limits for frequency:*

a. *Measure the frequency of the probe compensation signal:*

- From the button bar, touch **MEAS** and select the **Time** tab.
- Touch the **Freq** button.

b. *Check against limits:*

- CHECK that the **CH 1 Freq** readout is within 950 Hz to 1.050 kHz, inclusive. See Figure 4–32.
- Enter the frequency on the test record.
- Touch **Clear** to remove the measurement.

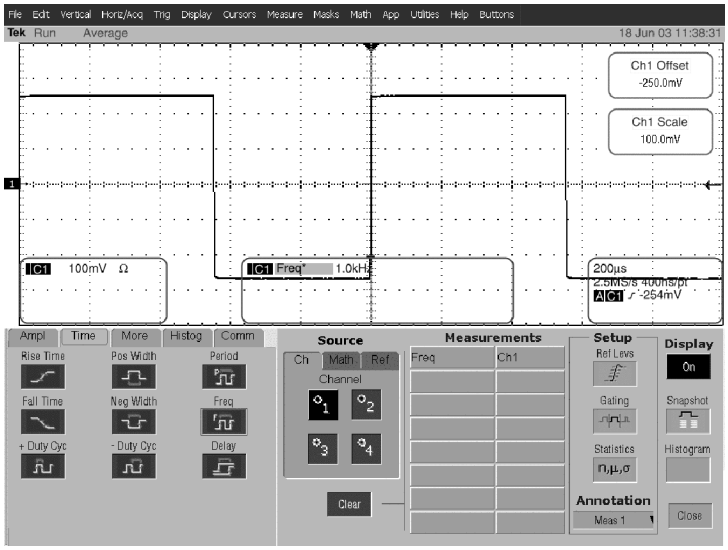


Figure 4–32: Measurement of probe compensator frequency

c. *Save the probe compensation signal in reference memory:*

- Touch **Refs**; then select the **Ref 1** tab.
- Touch the Save Wfm to Ref1 **Save** button to save the probe compensation signal in reference 1.
- Disconnect the cable from **CH 1** and the probe compensation connector.
- Touch the **Display** button to toggle it to on to displayed the stored signal.

d. *Hook up the DC standard source:*

- Set the output of a DC calibration generator to off or 0 volts.
- Connect the output of a DC calibration generator through a dual-banana connector followed by a 50 Ω precision coaxial cable to one side of a BNC T connector. See Figure 4–33.
- Connect the Sense input of the generator through a second dual-banana connector followed by a 50 Ω precision coaxial cable to the other side of the BNC T connector. Now connect the BNC T connector to **CH 1** through a TCA-BNC or BNC-to-SMA adapter. See Figure 4–33.

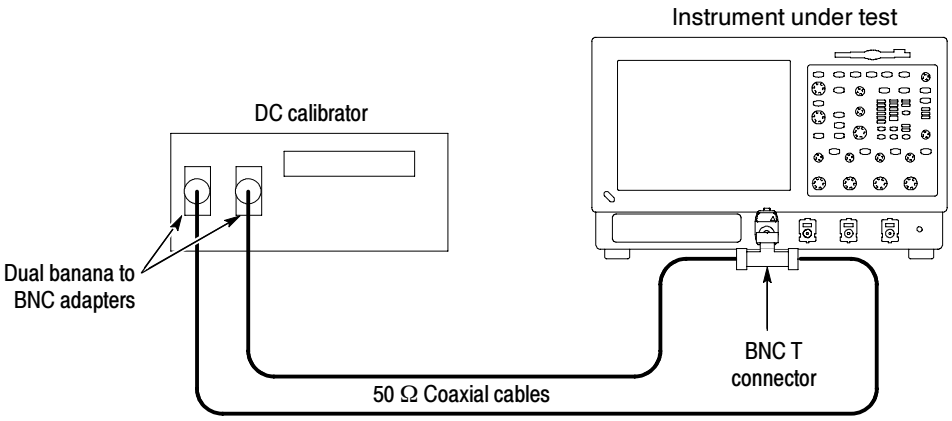


Figure 4- 33: Subsequent test hookup

e. *Measure amplitude of the probe compensation signal:*

- From the tool bar, touch **Horiz** and select the **Acquisition** tab.
- Touch **Average** and set the number of averages to **16** using the keypad or the multipurpose knob.

- Adjust the output of the DC calibration generator until it precisely overlaps the top (upper) level of the stored probe compensation signal. (This value will be near 0.0 V).
- Record the setting of the DC generator.
- Adjust the output of the DC calibration generator until it precisely overlaps the base (lower) level of the stored probe compensation signal. (This value will be near -500 mV).
- Record the setting of the DC generator.

f. Press **Close** to remove the menus from the display. See Figure 4-34.

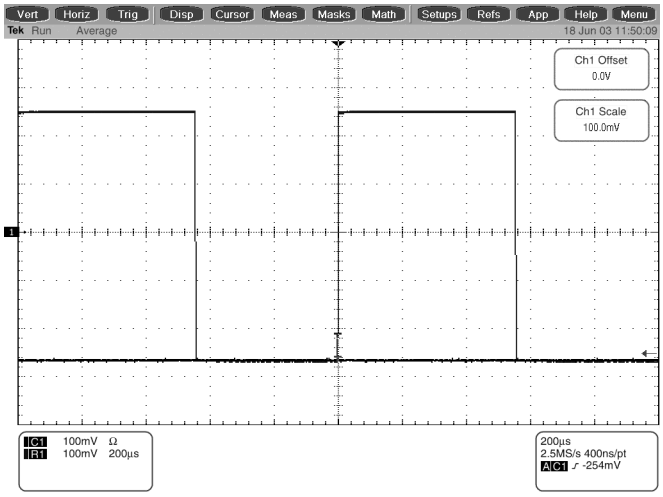


Figure 4-34: Measurement of probe compensator amplitude

g. *Check against limits:*

- Subtract the value just obtained (base level) from that obtained previously (top level).
- CHECK that the difference obtained is within 400 mV to 600 mV, inclusive.
- Enter voltage difference on test record.

3. *Disconnect the hookup:* Disconnect the cable and adapter from **CH 1**.

Serial Trigger Checks (TDS7000B Series Option ST and CSA7000B Series Only)

These procedures check those characteristics that relate to the serial trigger system and are listed as checked in *Specifications.*

Check Serial Trigger Baud Rate Limits and Word Recognizer Position Accuracy

Equipment required	One precision 50 Ω coaxial cables (Item 4) One sine-wave generator (Item 12) One SMA-to-BNC, TCA-BNC, or TCA-SMA adapters (Item 19)
Prerequisites	See page 4-17. Also, the instrument must have passed *Check DC Voltage Measurement Accuracy* on page 4-45.

1. *Install the test hookup and preset the instrument controls:*

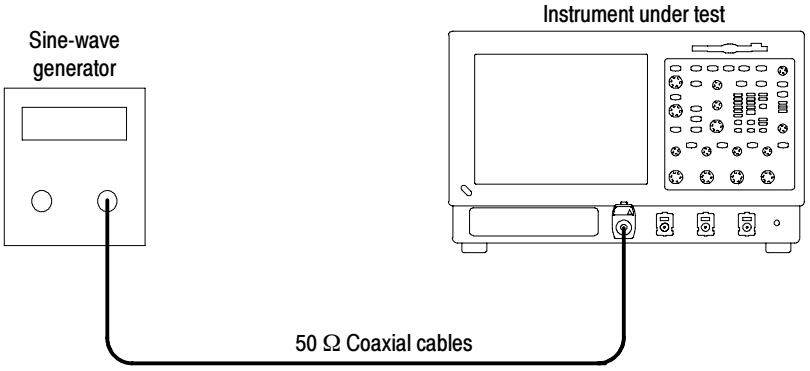


Figure 4-35: Initial test hookup

a. *Hook Up the test-signal source (see Figure 4-35):*

- Connect the sine wave output of the sine-wave generator through a 50 Ω precision coaxial cable to CH 1 through an adapter.
- Set the sine-wave generator to output a 433 MHz sine wave.

b. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

c. Modify the initialized front-panel control settings:

- Set the vertical **SCALE** to 50 mV per division.
- Set the horizontal **SCALE** to 2.5 ns per division.
- Adjust the sine-wave generator output for 4 divisions of amplitude centered on the display.

- Adjust the trigger **LEVEL** to trigger at 25% (–1 division) on the sine wave.

Table 4-10: Serial pattern data

Serial pattern data	Trigger location
B6DB 6DB6 DB6D $B6DB_{16}$	One UI before the 0
6DB6 DB6D B6DB $6DB6_{16}$	At the 0
DB6D B6DB 6DB6 $DB6D_{16}$	One UI after the 0

2. *Verify that the signal path can do isolated 0 and pattern matching circuits can do isolated 1:*

   a. From the button bar, touch **Cursors** and then the **Setup** button. If using the menu bar, touch **Cursors** and then select **Cursor Setup**. Touch the **Cursor** button to toggle it on and display the cursors.

   b. Set the Tracking Mode to **Tracking**.

   c. Touch the **Close** button.

   d. Adjust the cursors until the Δt readout equals 800 ps (one unit interval). Center the cursors around the center graticule line (see Figure 4–36).

   e. From the button bar, touch **Trig**, select the **A Event** tab, and touch the **Select** button.

   f. Touch the **Serial** button and then set the Standard to **GB Ethernet**.

   g. Touch the **Editor** button.

   h. Set the Format to **Hex** and then touch the **Clear** button.

   i. Enter data into the Serial Pattern Data field for one of the settings in Table 4–10 that is not yet checked. (Start with the first setting listed.)

   j. Touch **Apply**.

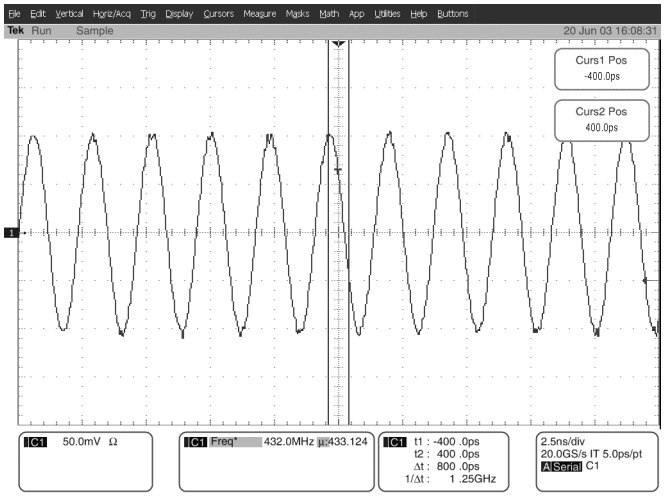
   k. Verify that the instrument triggers one Unit Interval (UI, one baud divided by the bit period) before the 0 in the input signal (see Figure 4–36). Enter pass or fail in the test record.

   l. Touch the **Clear** button.

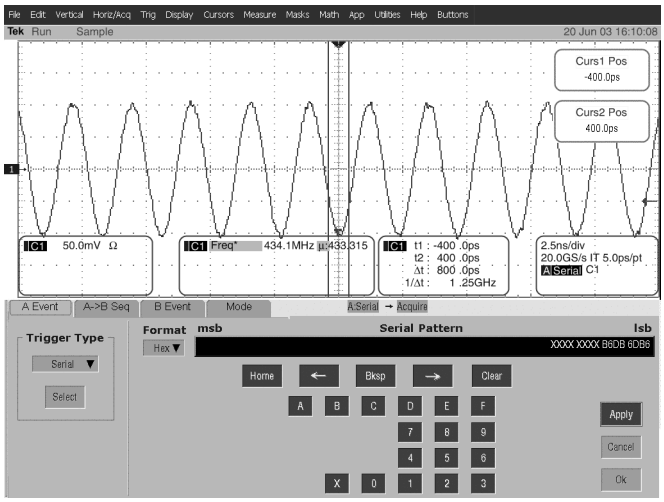
   m. Enter data into Serial Pattern Data field for the next setting in Table 4–10 that is not yet checked.

   n. Touch **Apply**.

Triggered 1 UI before a 0



Triggered on a 0



Triggered 1 UI after a 0

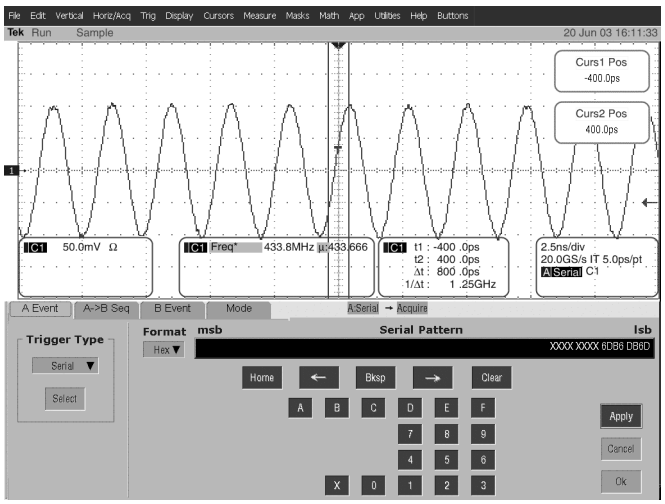


Figure 4- 36: Isolated 0 triggering

o. Verify that the instrument triggers at the 0 in the input signal (see Figure 4–36). Enter pass or fail in the test record.

p. Touch the **Clear** button.

q. Enter data into Serial Pattern Data field for the next setting in Table 4–10 that is not yet checked.

r. Touch **Apply**.

s. Verify that the instrument triggers one Unit Interval (UI) after the 0 in the input signal (see Figure 4–36). Enter pass or fail in the test record.

Table 4-11: Word recognizer data

Serial pattern data	Trigger location
$4924\ 9249\ 2492\ 4924_{16}$	One UI before the 1
$9249\ 2492\ 4924\ 9249_{16}$	At the 1
$2492\ 4924\ 9249\ 2492_{16}$	One UI after the 1

3. *Verify that the serial path and pattern matching circuits can do isolated 1s:*

a. Adjust the trigger **LEVEL** to trigger at 75% (+1 division) on the sine wave.

b. Touch the **Clear** button.

c. Enter data into the Serial Pattern Data field for one of the settings in Table 4–11 that is not yet checked. (Start with the first setting listed.)

d. Touch **Apply**.

e. Verify that the instrument triggers one Unit Interval (UI) before the 1 in the input signal (see Figure 4–37). Enter pass or fail in the test record.

f. Touch the **Clear** button.

g. Enter data into the Serial Pattern Data field for the next setting in Table 4–11 that is not yet checked.

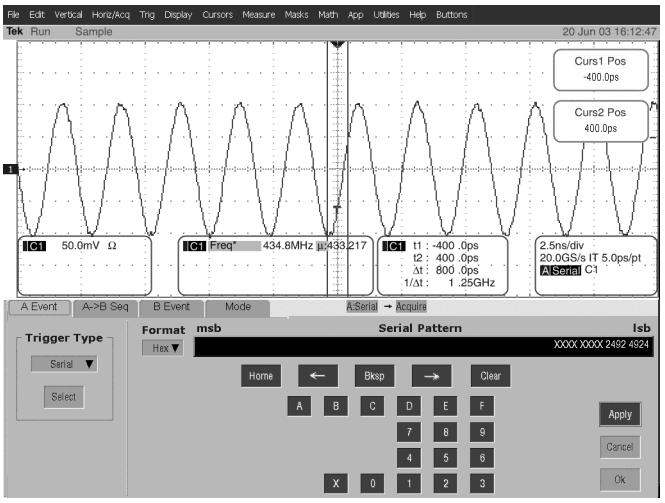
h. Touch **Apply**.

i. Verify that the instrument triggers at the 1 in the input signal (see Figure 4–37). Enter pass or fail in the test record.

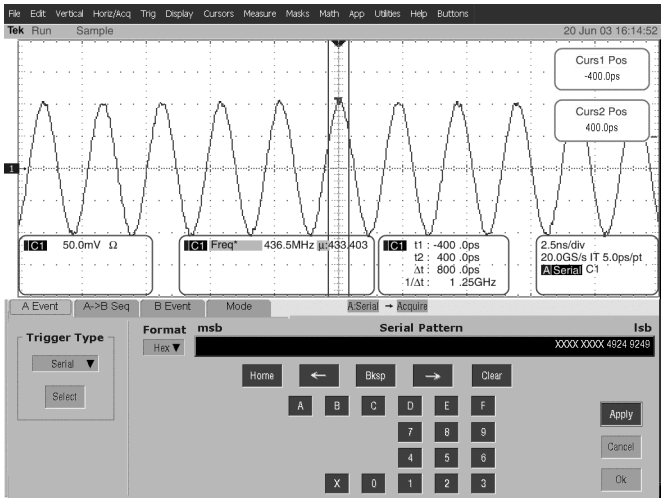
j. Touch the **Clear** button.

k. Enter data into the Serial Pattern Data field for the next setting in Table 4–11 that is not yet checked.

Triggered 1 UI before a 1



Triggered on a 1



Triggered 1 UI after a 1

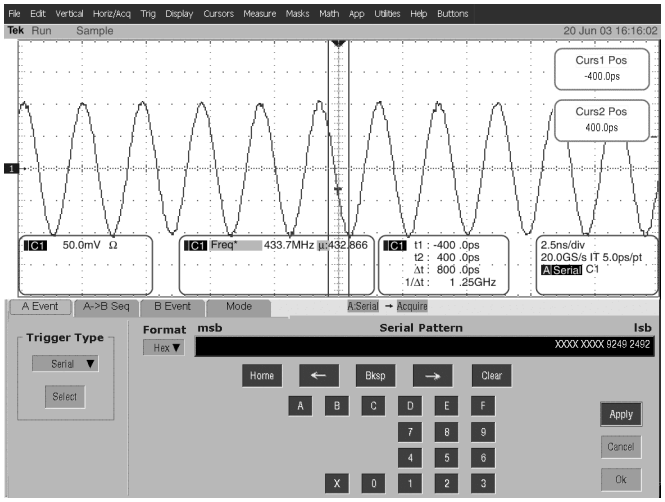


Figure 4- 37: Isolated 1 triggering

l. Touch **Apply**.

m. Verify that the instrument triggers one Unit Interval (UI) after the 1 in the input signal (see Figure 4–37). Enter pass or fail in the test record.

4. *Verify that the pattern matching circuits can do isolated 1:*

a. Adjust the trigger **LEVEL** to trigger at 75% (+1 division) on the sine wave.

b. Set the Format to **Binary** and then touch the **Clear** button.

NOTE*. When entering the Serial Pattern Data, you only need to enter the 1 and any trailing bits. When you touch the apply button, the instrument automatically fills all leading bit positions with an X (don't cares).*

c. Set the Serial Pattern Data pattern bits to XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXX1_2.

d. Touch **Apply**.

e. Verify that the instrument triggers on a 1 (see Figure 4–38). Enter pass or fail in the test record.

f. Touch the **Clear** button.

g. Set all Serial Pattern Data bits to X except for the nth bit, where n is the step number. For example: if step 4c is step 1 for bit 1, the pattern for step 2, bit 2 is XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX XX1X$_2$.

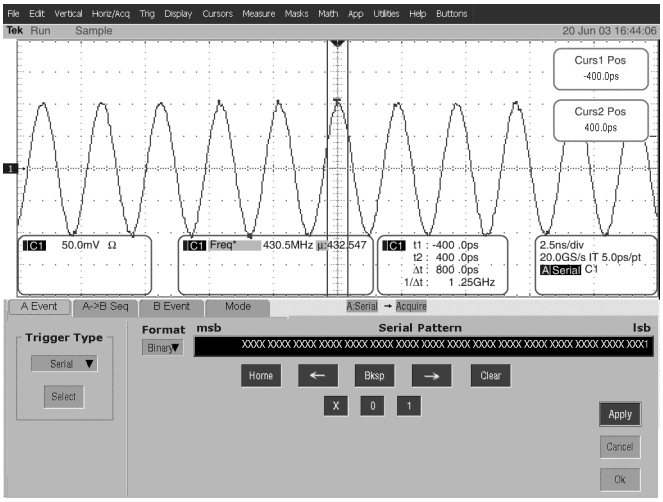
h. Touch **Apply**.

i. Verify that the trigger occurs (n modulo 3) clock cycles after the 1 (see Figure 4–38). Enter pass or fail in the test record.

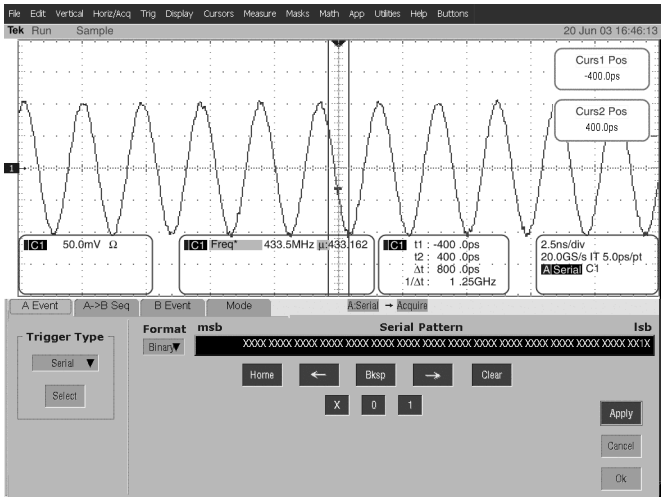
j. Repeat steps g and i until all 64 bits of the Serial Pattern Data have contained a 1.

5. *Disconnect the hookup:* Disconnect the cables and adapters from the inputs and outputs.

Triggering on a 1. Step 1, 4, 7, 10, . . .



Triggering 1 clock cycle after a 1. Step 2, 5, 8, 11, . . .



Triggering 2 clock cycles after a 1. Step 3, 6, 9, 12, . . .

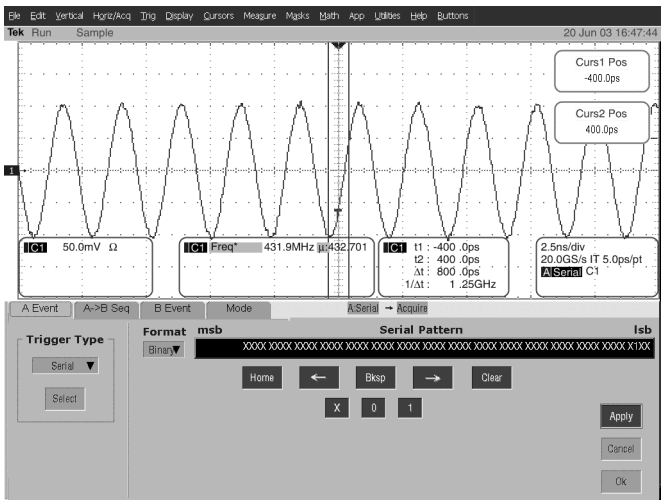


Figure 4- 38: N modulo 3 triggering

Check Serial Trigger Clock Recovery Range

Equipment required	One precision 50 Ω coaxial cables (Item 4) One sine-wave generator (Item 12) One SMA-to-BNC, TCA-BNC, or TCA-SMA adapters (Item 19)
Prerequisites	See page 4-17. Also, the instrument must have passed *Check DC Voltage Measurement Accuracy* on page 4-45.

1. *Install the test hookup and preset the instrument controls:*

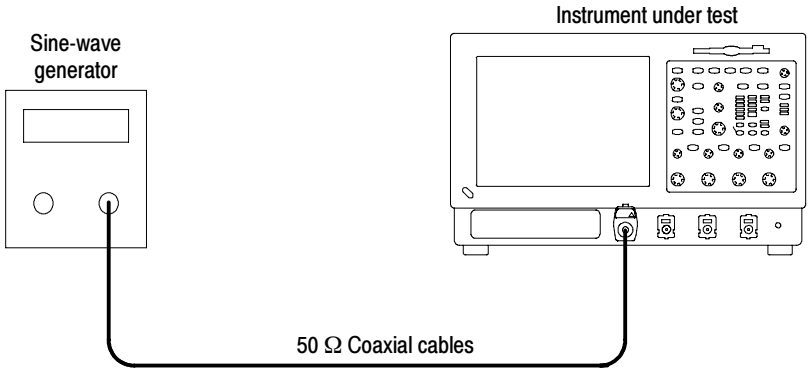


Figure 4-39: Initial test hookup

a. *Hook up test-signal source 1 (See Figure 4-39):*

- Connect the sine wave output of the sine-wave generator through a 50 Ω precision coaxial cable to CH 1 through an adapter.
- Set the sine-wave generator to output a 1.5625 GHz sine wave.

b. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

c. *Modify the initialized front-panel control settings:*

- Press the Vertical **SCALE** to 50 mV per division.
- Set the horizontal **SCALE** to 200 ps per division.
- From the button bar, touch the **Disp** (display) button.
- Set the Display Style to **Dots**.
- Set the Display Persistence to **Variable**, and set the Persist Time to **3.0 s**.
- Touch the **Close** button.

- Adjust the sine-wave generator output for 8 divisions of amplitude.
- From the button bar, touch **Trig** and select the **A Event** tab.
- Touch the **Select** button.
- Touch the **Comm** button. Set **Source** to Ch1, **Type** to R Clk, and **Coding** to NRZ.

2. *Verify the clock recovery at frequency:*

   a. From the button bar, touch **Trig** and select the **A Event** tab.

   b. Set the sine-wave generator to output one of the input frequencies in Table 4–12 (on page 4–123) that is not yet checked. (Start with the first setting listed.)

   c. Set the instrument Bit Rate to the Recovered clock Baud rate listed in the table for the current input frequency.

NOTE*. The instrument will attempt to acquire lock once. If the input data is disrupted, removed, or heavily distorted, the instrument may not acquire lock or may loose lock. If the recovered clock is not locked to the incoming data, the waveform display will not be stable (see Figure 4–40). Once the input data is available, press the PUSH SET TO 50% knob to force the instrument to acquire lock again.*

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   d. Press **PUSH TO SET 50%**.

NOTE*. As the input frequency is lowered, adjust the Horizontal SCALE to maintain about 3 to 5 eyes across the display.*

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   e. Verify that lock is acquired as in Figure 4–40.

   f. Repeat substeps b through d for each input frequency and Baud rate listed in Table 4–12 (on page 4–123).

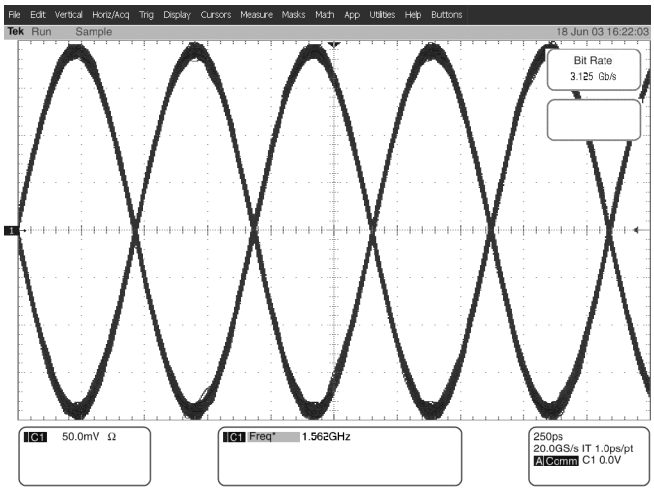
   g. If all tests pass, enter passed in the test record.

3. *Disconnect the hookup:* Disconnect the cables and adapters from the inputs and outputs.

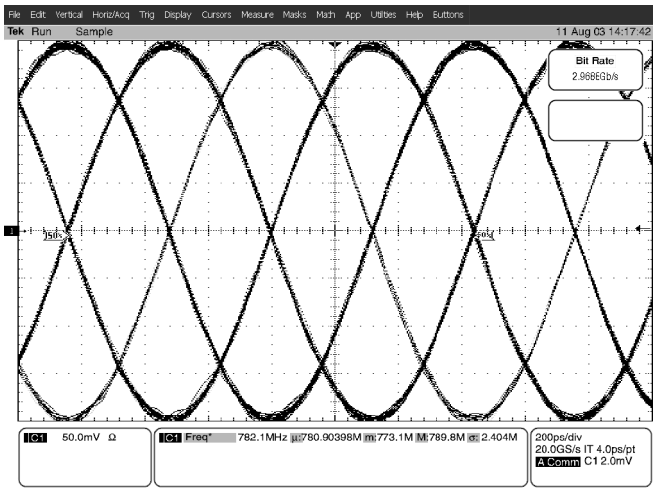
Table 4-12: Clock recovery input frequencies and baud rates

Input frequency	Recovered clock Baud rate
1.5625 GHz	3125 Mbaud
781.25MHz	3125 Mbaud
781.25 MHz	2968.8 Mbaud
742.19 MHz	3125 Mbaud
600 MHz	2400 Mbaud
575.00 MHz	2300 Mbaud
575.00 MHz	2185 Mbaud
546.25 MHz	2300 Mbaud
390.63 MHz	1562.5 Mbaud
388.13 MHz	1552.5 Mbaud
194.06 MHz	776.25 Mbaud
194.06 MHz	737.44 Mbaud
184.36 MHz	776.25 Mbaud
136.44 MHz,	574.50Mbaud
143.27 MHz	545.78 Mbaud
97.031 MHz	388.13 Mbaud
48.766 MHz	195.06 Mbaud
24.383 MHz	97.531 Mbaud
12.191 MHz	48.766 Mbaud
6.0957 MHz	24.383 Mbaud
3.0479 MHz	12.191 Mbaud
1.5239 MHz	6.0957 Mbaud
761.96 kHz	3.0479 Mbaud
380.98 kHz	1.5239 Mbaud

Recovered clock locked (1.5625 GHz)



Recovered clock locked (All frequencies except 1.5625 GHz)



A possible display with the recovered clock not locked

Figure 4- 40: Clock recovery

Optical-to-Electrical Converter Checks (CSA7000B Series Only)

The procedure that follows checks those characteristics of the Optical-to-electrical converter that are listed as checked under *Warranted Characteristics* in *Specifications.*

Check Dark Level Calibration

Equipment required	Fiber-optic dust cap (Item 38) O/E electrical out-to-CH1 input adapter (Item 32)
Prerequisites	See page 4-17. Also, the instrument must have passed *Check DC Voltage Measurement Accuracy* on page 4-45.

1. *Install the test hookup and preset the instrument controls:*
   a. *Hook up test-signal source 1 (See Figure 4-41 on page 4-125):*
      - Install the O/E Electrical Out-to-CH 1 Input adapter on the CSA Instrument.
      - Install the fibre-optic dust cap onto the OPTICAL INPUT connector of the O/E converter.

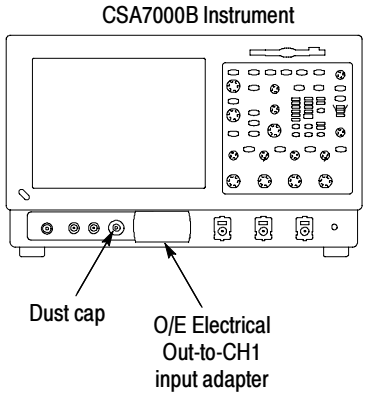


Figure 4-41: Initial test hookup

2. Follow this procedure to make the Dark Level checks:
   a. In the **Utilities** menu, select Instrument **Calibration**. Check that the Status is Pass.
   b. Press the **Calibrate** button.
   c. Wait until the compensation is completed.

d. Check that the Status is **Pass**.

e. From the tool bar, touch **Vert** and select the Chan **1** tab.

f. Select a Wavelength.

3. Follow this procedure to calibrate the Dark Level:

a. Press Dark Level **Calibration** and wait for the compensation to complete.

b. Wait until the compensation is completed.

c. Check that the Status is **Pass**.

4. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

5. *Modify the initialized front-panel control settings:*

- From the tool bar, touch **Meas** and select the **Ampl** tab.
- Touch **Mean**.
- From the tool bar, touch **Horiz** and select the **Acquisition** tab.
- Touch **Average** and set the number of averages to **64**.
- Touch the **Close** button.
- Set the Vertical **SCALE** to 10 μW.

Table 4-13: Dark level

Scale setting	Accuracy limits
10 μW	≤2.6 μW
20 μW	≤3.6 μW
50 μW	≤6.6 μW

6. *Confirm Dark Level is within limits:* Do the following substeps — test the scale settings in Table 4–13.

a. Select an unchecked scale setting from Table 4–13.

b. CHECK that the **CH 1 Mean** readout is within the limits listed for the current scale setting in the table. Record the mean on the test record.

7. Repeat step 6 until all scale settings have been checked.

Check Maximum Optical-to-Electrical Noise

Equipment required	Fiber-optic dust cap (Item 38) O/E electrical out-to-CH1 input adapter (Item 32)
Prerequisites	See page 4-17. Also, the instrument must have passed *Check DC Voltage Measurement Accuracy* on page 4-45.

This procedure checks the optical-to-electrical noise. The check is made with vertical offset set to zero and no optical signal input (dust cap installed on the OPTICAL INPUT).

1. *Install the test hookup and preset the instrument controls (See Figure 4-42):*

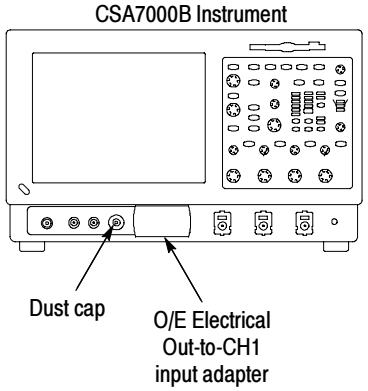


Figure 4-42: Initial test hookup

a. Install the fibre-optic dust cap onto the OPTICAL INPUT connector of the O/E converter.

b. Install the O/E Electrical Out-to-CH 1 Input adapter on the CSA Instrument.

c. Press the **DEFAULT SETUP** button.

d. Select **CH1** for the waveform source.

e. From the tool bar, touch the **Vert** button and select the **CH1** tab.

f. Set the **Scale** to **50 µW/div**

g. Set **Position** to 0.0div.

h. Set Channel **Offset** to 0.0W.

i. From the tool bar, touch the **Horiz** button and select the **Horizontal** tab.

j. Set the **Scale** to 20 ns/div.

k. Set the Record Length to **4000**.

l. From the tool bar, touch the **Meas** button and select the **Histo** tab.

m. Press the **Mean**, **Std Dev**, and **Statistics** buttons.

n. Set the Measurement Statistics to **Mean** and press the **Setup** button.

o. Press the **Histogram** button, and set the Histogram Mode to **Vert**, the Display to **On**, and set the Source to Channel **1**.

p. Press the **Advanced** button.

q. Press the **Close** button.

2. Follow this procedure to make the Optical Noise checks:

a. From the tool bar, touch **Vert** and select the **Chan 1** tab.

b. Select a calibrated Wavelength.

c. Press the **Close** button.

d. Change the Horizontal Scale and then return the Scale to 20 ns/div.

e. *Confirm Optical Noise is within limits:* After a few seconds, note the Mean and the Std Dev results displayed for the selected wavelength. The mean of the histogram is the dark level value and the standard deviation of the histogram is the maximum RMS optical noise value. Refer to Table 4–14. Enter the value in the test record.

f. Repeat steps a through e for each available wavelength.

Table 4-14: Optical noise limits

Instrument	Maximum optical noise, std
CSA7404B	
1550 and 1310 nm	4.35 μW
850 nm	5.35 μW
780 nm	5.85 μW

3. *Disconnect the hookup:* Disconnect the adapters from the inputs and outputs.

Check Optical-to-Electrical Gain

Equipment required	Two 62.5 μm multimode fiber-optic cables (Item 34) SMA cable (Item 21) CW laser source (Item 29) Multimode optical attenuator (Item 30) Optical power meter (Item 31) O/E-to-SMA adapter (Item 33) TCA-SMA adapter (item 19)
Prerequisites	See page 4-17. Also, the instrument must have passed *Check DC Voltage Measurement Accuracy* on page 4-45.

1. *Install the test hookup and preset the instrument controls:*

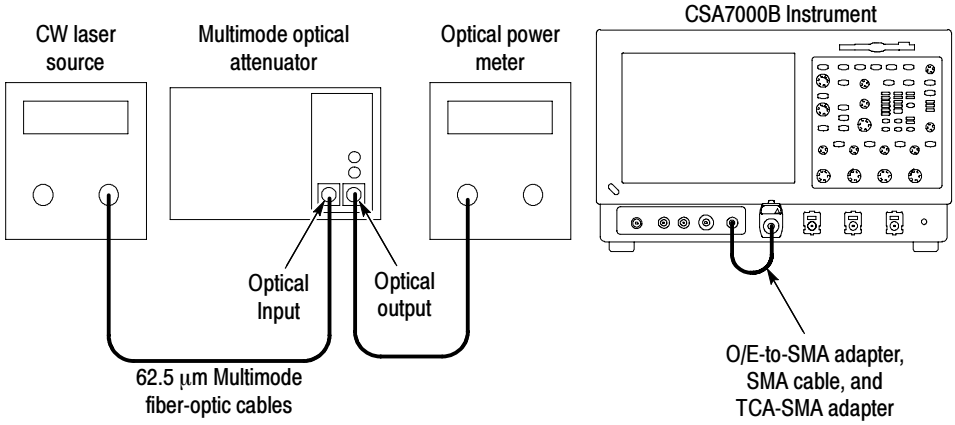


Figure 4-43: Initial test hookup

a. *Hook up test-signal source 1 (See Figure 4-43):*

- Connect the O/E Electrical Output to the CH 1 Input using an O/E-to-SMA adapter, SMA cable, and TCA-SMA adapter.
- Connect the output of a CW laser source through a multimode optical-fiber cable to the optical input of a multimode optical attenuator.
- Connect the output of the optical attenuator to the input of the optical power meter.
- Set the CW laser source to 780 nm.
- Set the multimode optical attenuator for 0.1 mW (-10 dBm) into the optical power meter.

- Move the optical fiber from the optical power meter to the optical input of the CSA Instrument.

b. *Initialize the instrument:* Press the **DEFAULT SETUP** button.

c. *Modify the initialized front-panel control settings:*

- From the tool bar, touch **Meas** and select the **Ampl** tab.
- Touch **Mean**.
- From the tool bar, touch **Horiz** and select the **Acquisition** tab.
- Touch **Average** and set the number of averages to **64**.
- Touch the **Close** button.
- Set the Vertical **SCALE** to 20 mV per division.
- Set the Horizontal **SCALE** to 200 μs.

Table 4-15: O/E gain

Wavelength setting	Vertical scale setting	Attenuator output setting	Accuracy limits
780 nm	20 mV	0.1 mW (-10 dBm)	≥ 27 mV
850 nm	20 mV	0.1 mW (-10 dBm)	≥ 33 mV
1310 nm	50 mV	0.1 mW (-10 dBm)	≥ 64 mV
1550 nm	50 mV	0.1 mW (-10 dBm)	≥ 64 mV

2. *Confirm O/E Gain is within limits:* Do the following substeps — test the first wavelength setting in Table 4-15 first, skipping substep a since 780 nm is already selected from step 1.

a. Select and unchecked wavelength from Table 4-15.

- Move the optical fiber from optical input of the the CSA Instrument to the optical power meter.
- Set the CW laser source to wavelength not yet checked from Table 4-15.
- Set the Vertical **SCALE** to the setting in Table 4-15 for the selected wavelength.
- Set the multimode optical attenuator for 0.1 mW out of the optical power meter.

- Move the optical fiber from the optical power meter to the optical input of the CSA Instrument.

b. CHECK that the **CH 1 Mean** readout is within the limits listed for the current wavelength setting in the table. Record the mean on the test record.

c. Repeat substeps 2.a. and 2.b. until all wavelengths listed in Table 4–15 have been tested.

3. *Disconnect the hookup:* Disconnect the cables and adapters from the inputs and outputs.

Check Optical-to-Electrical System Bandwidth

Before performing the checks for minimum optical bandwidth, you need to have an understanding of what optical bandwidth is and how it is measured.

Traditionally, the bandwidth of a device or system is defined as the frequency at which the power out of the same device or system is one half as compared with a frequency near DC. In the voltage domain, the power dissipated into a resistive load (for example, a 50 Ω termination of a sampler) is the V_{RMS}^2/R where V_{RMS} is the RMS of the voltage swing seen at the resistive load, and R is the resistance value. A logarithmic scale using decibels is typically used to describe a frequency dependent response of a system.

A value expressed in terms of a decibel relative to a reference is defined as:

$$dB = 10 \times \log\left(\frac{value}{reference}\right)$$

For electrical bandwidths, the power ratio is used so:

$$dB = 10 \times \log\left(\frac{Power_f}{Power_{DC}}\right)$$

when

$$\frac{Power_f}{Power_{DC}} = \frac{1}{2}$$

$$10 \times \log\left(\frac{1}{2}\right) = -3\ dB$$

In terms of voltage, and resistance, the bandwidth is expressed as:

$$-3\ dB = 10 \times \log\left[\frac{\frac{V_f^2}{R}}{\frac{V_{DC}^2}{R}}\right]$$

where V_f is the RMS of the voltage swing response at the bandwidth frequency and V_{DC} is the RMS voltage swing response at a frequency approaching DC. Further math yields that $V_f = 0.707 \times V_{DC}$. The expression is simplified by the cancellation of the R and the movement of the squared term inside the log expression to a multiple outside the log expression:

$$10 \times \log \left(\frac{\frac{V_f{}^2}{R}}{\frac{V_{DC}{}^2}{R}} \right) = 2 \times 10 \times \log \left(\frac{V_f}{V_{DC}} \right) = 20 \times \log \left(\frac{V_f}{V_{DC}} \right)$$

therefore at

$$-3\ dB\ \frac{V_f}{V_{DC}} = 0.707$$

In some instances, the vertical units displayed for an optical signal are not in voltage, but are in watts, which is a unit of power. The O/E converter outputs a voltage swing whose amplitude is linearly dependent on the incoming optical power swing. In this condition the voltage applied at the electrical sampler already represents Optical Power in its linear form (as opposed to having to square the voltage and divide by R). For the O/E converter, then, the bandwidth where the displayed optical power is one half that approaching DC is:

$$dB = 10 \times \log \left(\frac{Power_f}{Power_{DC}} \right) = -3\ dB$$

The V_f in such a system is one half (0.5) the V_{DC} as opposed to 0.707. The optical bandwidth, therefore, corresponds to the traditional electrical bandwidth at –6 dB. During testing of O/E converter via impulse testing, the resulting impulse waveform is converted to frequency via Fourier transform, and the bandwidth is defined as:

$$-3\ dB = 10 \times \log \left(\frac{vertical\ swing\ @\ frequency}{vertical\ swing\ @\ DC} \right)$$

This definition is used for bandwidth settings.

During reference receiver curve calculation, however, the definition is changed to match the industry standard definition, which was authored assuming electrical bandwidths where:

$$-3\ dB = 20 \times \log \left(\frac{vertical\ swing\ @\ frequency}{vertical\ swing\ @\ DC} \right)$$

This definition is used for reference receiver settings.

This procedure checks the minimum optical bandwidth of the instrument.

***NOTE**. To optimize performance, make sure that all connections are clean and secure and that all components of the system are in good condition. Optical fiber can gradually degrade the system performance as it is repeatedly flexed over time.*

Equipment required	Optical impulser (item 28) Tektronix OA5022 variable optical attenuator (item 30) Multimode fiber-optic cable, 2 m, FC to FC connectors (item 34) Optical attenuator, 10 dB, FC-FC, female-male connectors (item 35) O/E Electrical Out-to-CH 1 Input adapter (Item 32)
Prerequisites	See page 4-17

Before performing this procedure, be sure you have completed the Optical Noise procedure on page 4-127.

Setup

Install the test hookup and preset the controls:

1. Install the test hookup as shown in Figure 4-44.
2. Start with about 30 dB of attenuation on the variable attenuator.

***NOTE**. To avoid dispersing the narrow optical impulse signal, keep all fiber lengths as short as possible. Lengths that are 2 to 3 meters long are acceptable.*

3. *Initialize the instrument:* Press the **DEFAULT SETUP** button.
4. From the tool bar, touch **Horiz** and select the Acquisition tab.
5. Select the **Average** acquisition mode. Set the number of averages to **64**. Touch the **Equivalent Time ET** button.

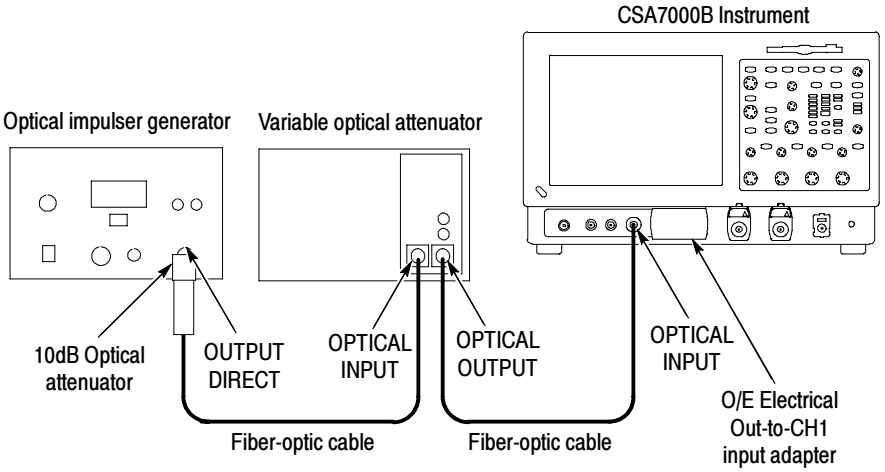


Figure 4-44: Optical bandwidth hookup

6. Select the Horizontal tab, do the following;

   a. Set the **Scale** to **2.5 ns/div**. (This setting will make it easier to initially locate the optical pulse later in the procedure.)

   b. Set the **Position** to **15.0%**. (This setting will make it easier to locate the first optical pulse later in the procedure.)

   c. Set the **Rec Length** to **500**. Verify that the sample rate is still set to 20 GS/s.

7. From the tool bar, touch **Vert**, do the the following:

   a. Set the **Scale** to **20.0 µW/div**.

   b. Set **Position** to **-2.0 div**.

   c. Set the Calibrated Wavelength to **1550 nm**.

8. Press the **PUSH TO SET 50%** button to set the trigger point midway on the rising signal.

9. Decrease the amount of attenuation provided by the optical attenuator until a pulse appears.

10. Adjust the attenuation of the variable optical attenuator until it produces an impulse pulse amplitude of 80 $\mu W_{p-p.}$ See Figure 4-45.

Procedure Follow this procedure to make the optical system bandwidth checks:

Table 4-16: O/E system bandwidth

Instrument	Bandwidth -3 dB (-6 dBm on readout)
CSA7404B	2.4 GHz

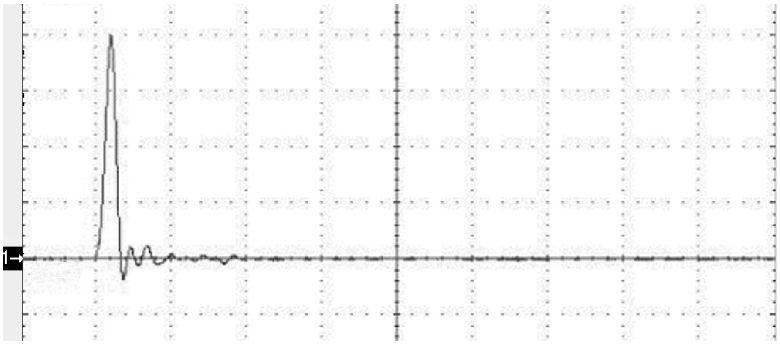


Figure 4-45: Proper positioning of the impulse

11. *Turn on a magnitude FFT of the optical impulse [the Impulse Response (or Frequency Response) of the system] (Refer to Figure 4-45):*

a. From the tool bar, touch **Math** and select the Math 1 tab.

b. Press the Spectral Analysis **Setup** button and select the **Create** tab.

c. Press the **Magnitude** button and then the **Channel 1** button to create a magnitude FFT math waveform.

d. From the **Window Type** drop down list, select **Rectangular.**

e. Select the Mag tab.

f. Press the Scale **dBm** button.

g. Press **Freq Span** and use the general purpose knobs to adjust the frequency span to 5 GHz. Set the Center Frequency to 2.5 GHz (a frequency span of 4 GHz and center frequency of 2 GHz are also acceptable).

h. Set the Ref Level to **-5.2 dBm** and press **Apply**.

i. From the tool bar, touch **Math** and select the Math 1 tab.

j. Set the Math Scale to 3 dBm per division.

12. *Observe the desired response characteristics using the vertical paired cursors (see Figure 4–46):*

a. Press the front-panel **CURSOR button.**

b. Press the Cursor Type **Waveform** button.

c. Press Cursor1 if it is not already selected.

d. Select the Math tab and press **Math 1.**

e. Press Cursor2, select the Math tab, and set to **Math1**.

f. Press **Close.**

***NOTE**. Pressing the FINE button will change cursor speed.*

g. Position the first cursor at 400 MHz.

h. Position the second cursor (Δy) to the –6 dBm point (see Table 4–16 and Figure 4–46).

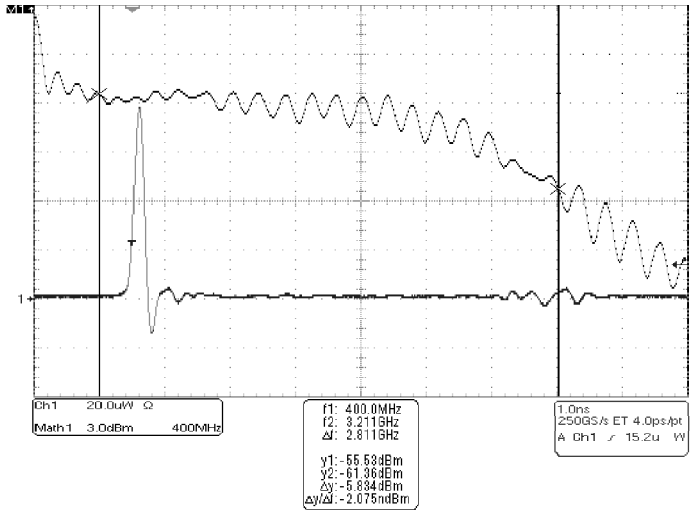


Figure 4- 46: Optical impulse response

***NOTE**. In Figure 4–46, the left cursor is at the DC frequency. The right cursor is at the –3 dB frequency.*

i. The f2 readout should be at or above the limit shown in Table 4–16.

j. Check that the instrument meets the bandwidth specification at –3 dB (–6 dBm in readout) as listed in Table 4–16. Enter value on test record.

13. *Disconnect the hookup:* Disconnect the cables and adapters from the instruments.

Sine Wave Generator Leveling Procedure

Some procedures in this manual require a sine wave generator to produce the necessary test signals. If you do not have a leveled sine wave generator, the following procedure to level the output amplitude of your sine wave generator.

Equipment required	Sine wave generator (Item 12) Level meter and power sensor (Item 13) Two male N to female BNC adapters (Item 15) One SMA-to-BNC adapter (Item 19) Two precision coaxial cables (Item 4)
Prerequisites	See page 4-17

1. *Install the test hookup:* Connect the equipment as shown in Figure 4–47 (start with the sine wave generator connected to the instrument).

2. *Set the Generator:*

- Set the sine wave generator to a reference frequency of 10 MHz.
- Adjust the sine wave generator amplitude to the required number of divisions as measured by the instrument.

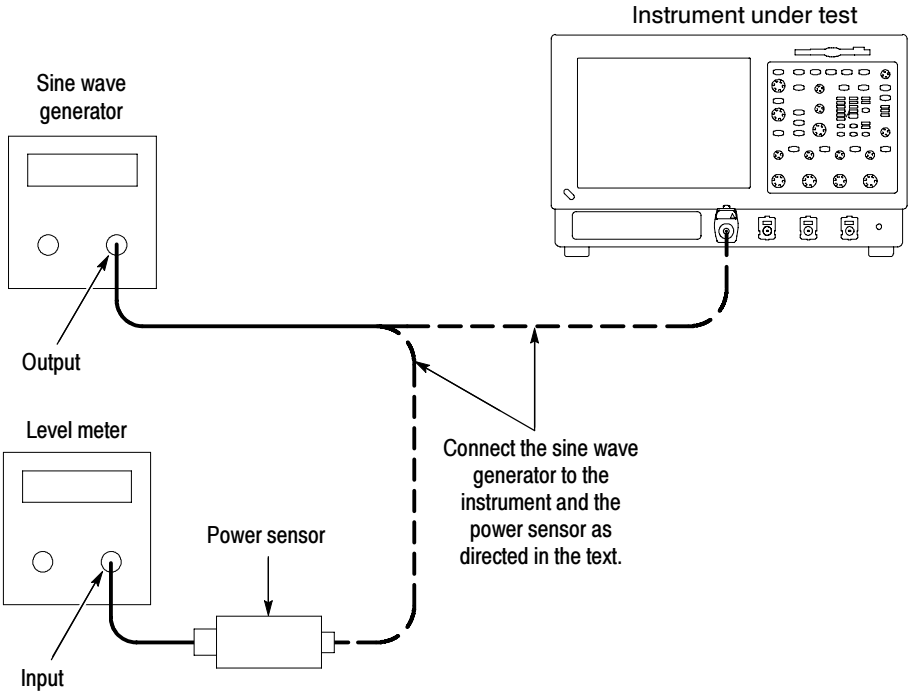


Figure 4- 47: Equipment setup for maximum amplitude

3. *Record the reference level:*
   - Disconnect the sine wave generator from the instrument.
   - Connect the sine wave generator to the power sensor.
   - Note the level meter reading.
4. *Set the generator to the new frequency and reference level:*
   - Change the sine wave generator to the desired new frequency.
   - Input the correction factor and/or the new frequency into the level meter.
   - Adjust the sine wave generator amplitude until the level meter again reads the value noted in step 3. The signal amplitude is now correctly set for the new frequency.
   - Disconnect the sine wave generator from the power sensor.
   - Connect the sine wave generator to the instrument.

Adjustment Procedures