

# DSA8300 Digital Serial Analyzer Performance Verification Technical Reference



077-0682-01

**Tektronix**



# **DSA8300 Digital Serial Analyzer Performance Verification Technical Reference**

## **Warning**

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

[www.tektronix.com](http://www.tektronix.com)

077-0682-01

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## General safety summary

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

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

*Only qualified personnel should perform service procedures.*

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

### To avoid fire or personal injury

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

**Connect and disconnect properly.** Connect the probe output to the measurement instrument before connecting the probe to the circuit under test. Connect the probe reference lead to the circuit under test before connecting the probe input. Disconnect the probe input and the probe reference lead from the circuit under test before disconnecting the probe from the measurement instrument.

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

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

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

The inputs are not rated for connection to mains or Category II, III, or IV circuits.

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

**Power disconnect.** The power switch disconnects the product from the power source. See instructions for the location. Do not block the power switch; it must remain accessible to the user at all times.

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

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

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

**Use proper fuse.** Use only the fuse type and rating specified for this product.

**Wear eye protection.** Wear eye protection if exposure to high-intensity rays or laser radiation exists.

**Do not operate in wet/damp conditions.**

**Do not operate in an explosive atmosphere.**

**Keep product surfaces clean and dry.**

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

### Terms in this manual

These terms may appear in this manual:



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



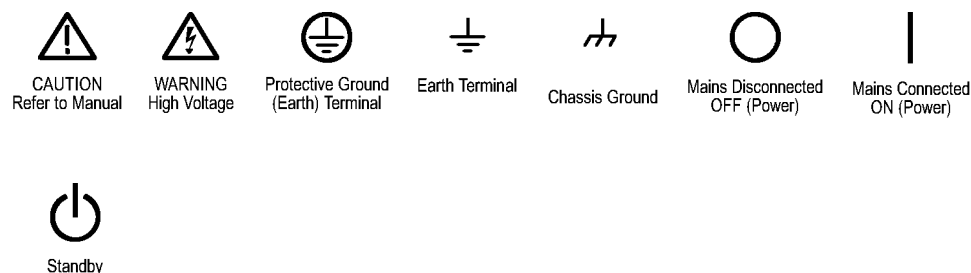
**CAUTION.** *Caution statements identify conditions or practices that could result in damage to this product or other property.*

### Symbols and terms on the product

These terms may appear on the product:

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

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



## Service safety summary

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

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

**Disconnect power.** To avoid electric shock, switch off the instrument power, then disconnect the power cord from the mains power.

**Use care when servicing with power on.** Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

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# Preface

This manual contains the specifications and performance verification procedures for the DSA8300 Digital Serial Analyzer, the extender cables, and the modules that can be installed in this instrument (except the 80A03 module).

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**NOTE.** *The 80A03 instruction manual contains its own specifications and servicing information.*

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Read this preface to learn how this manual is structured, what conventions it uses, and where you can find other information related to this product.

## Manual Structure

This manual is divided into chapters that are made up of related subordinate topics. These topics can be cross referenced as sections.

Be sure to read the introductions to all procedures. These introductions provide important information needed to do the service correctly, safely, and efficiently.

## Manual Conventions

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

- |                |  |
|----------------|--|
| <b>Modules</b> | Throughout this manual, the term <i>module</i> appears. A module is composed of electrical and mechanical assemblies, circuit cards, interconnecting cables, and a user-accessible front panel. References to a module are different than references to products such as “Sampling modules”, “Phase Reference modules”, or “Accessory modules”, which are products installed in the instrument compartments or on extender cables. |
| <b>Safety</b>  | Symbols and terms related to safety appear in the <i>General Safety Summary</i> found at the beginning of this manual.   |

## Related Documentation

The following documents relate to the instrument this manual supports:

- *DSA8300 Digital Serial Analyzer Quick Start User Manual*. Tektronix part number 071-2897-XX.
- *DSA8300 Digital Serial Analyzer Service Manual*. Tektronix part number 071-2049-XX.
- *DSA8300 Digital Serial Analyzer Online Help*. Installed with the application software and accessed from the instrument Help menu.
- *DSA8300 Digital Serial Analyzer Programmer Guide*. An online document accessed from the instrument Help menu.
- *80E01, 80E02, 80E03, 80E04, and 80E06 Electrical Sampling Modules User Manual*. Tektronix part number 071-0434-XX.
- *80E07, 80E08, 80E09, and 80E10 Electrical Sampling Remote Modules User Manual*. Tektronix part number 071-2038-XX.
- *80C00 Series Optical Sampling Modules User Manual*. Tektronix part number 071-0435-XX.
- *80C12B Optical Sampling Modules User Manual*. Tektronix part number 071-2994-XX.
- *80C14 Optical Sampling Modules User Manual*. Tektronix part number 071-2955-XX.
- *80A02 EOS/ESD Protection Module Instructions*. Tektronix part number 071-1317-XX.
- *80A03 TekConnect Probe Interface Module Instructions*. Tektronix part number 071-1298-XX.
- *80A05 Electrical Clock Recovery Module User Manual*. Tektronix part number 071-1467-XX.
- *DSA8300, DSA8200, CSA8200, CSA8000, CSA8000B, TDS8200, TDS8000, and TDS8000B Rackmount Kit Instructions*. Tektronix part number 071-0696-XX.
- *80N01 Extender Cable Instructions*. Tektronix part number 071-2037-XX.



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# Performance Verification Procedures



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# Performance Verification Procedures

Two types of Performance Verification procedures can be performed on this product: *Brief Procedures* and the more extensive *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 *Perform the Diagnostics* and *Perform the Compensation* procedures. (See page 1-2, *Functional Test Procedures*.)

**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 procedures just mentioned, and then do the procedure *Perform the Functional Tests*,. (See page 1-2, *Functional Test Procedures*.)

**Advantages:** These procedures require minimal additional time to perform, require no additional equipment other than connection hardware, and 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* after doing the procedures just referenced. (See page 1-16, *Performance Tests*.)

**Advantages:** These procedures add direct checking of warranted specifications. They require more time to perform and suitable test equipment is required. (See page 1-18, *Equipment Required*.)

If you are not familiar with operating this instrument, refer to the online help or the user information supplied with the instruments.

# Functional Test Procedures

There are three procedures in this section that provide a quick way to confirm basic functionality and proper adjustment of the DSA8300:

- (See page 1-2, *Instrument Diagnostics*.)
- (See page 1-3, *Instrument and Module Compensation*.)
- (See page 1-6, *Instrument Functional Tests*.)

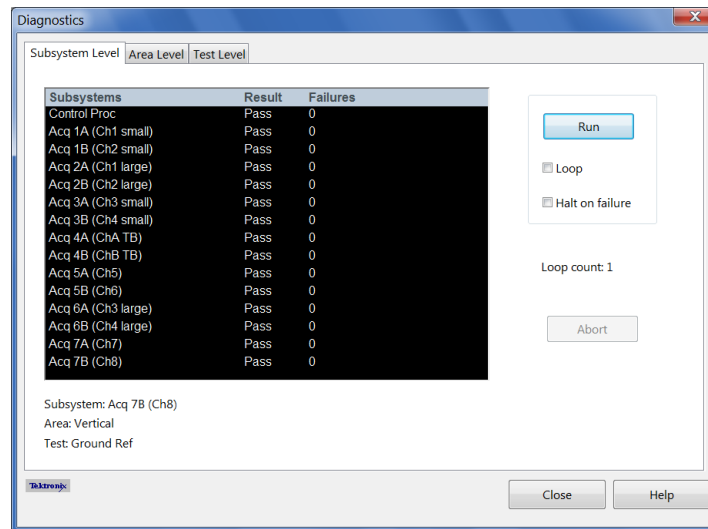
These procedures require little or no test equipment. For information on when to use these procedures, refer to Performance Verification Procedures. (See page 1-1, *Performance Verification Procedures*.)

## Instrument Diagnostics

The following steps run the internal routines that confirm basic functionality and proper adjustment.

<b>Equipment required</b>	None
<b>Prerequisites</b>	Install all sampling modules to be diagnosed: see module user manual for installation instructions.  Power on the instrument and wait 20 minutes (warm-up period) before doing this procedure.

1. *Set up the instrument:* Click **Utilities > Diagnostics** to open the Diagnostics dialog box.



2. *Select a diagnostics suite:*
  - a. Click the **Subsystem** Level tab.
  - b. Select all tests (click and hold the first entry (Control Proc) and drag down to highlight all entries as shown above).
  - c. Leave Loop and Halt on Failure unchecked (Run area).
3. *Verify that the diagnostic suite passes:*
  - a. Click **Run**. The diagnostics may take several minutes to complete.
  - b. Verify that Pass appears in the dialog box Status column when the diagnostics complete. If an error number appears as Status, rerun the diagnostics. If Fail status continues after rerunning compensation and you have allowed warm up to occur, the module or main instrument may need service.
  - c. Click **Close** to exit.

*End of Procedure*

## Instrument and Module Compensation

Performing a vertical compensation will maximize the accuracy of the automatic measurements you take. This procedure uses internal routines to optimize the vertical offset, gain, and linearity.

A complete compensation requires running separate compensations on the mainframe and the modules.

**Equipment required**

For sampling modules:

- 50  $\Omega$  terminations on all electrical module channels (Tektronix part number 015-1022-xx).
- Dust covers on all optical module channels.

The sampling modules ship from Tektronix with the proper terminations and dust covers installed.

**Prerequisites**

Install all sampling modules you plan to use for your measurements: see module user manual for installation instructions and ESD handling procedures.

Power on the instrument and wait 20 minutes (warm-up period) before doing this procedure.



**CAUTION.** *Electrostatic discharge (ESD) can damage sampling module inputs and outputs. Always store and transport modules in a static-free container, with their supplied terminations installed. Do not transport or ship the instrument with the modules installed in the instrument compartments.*

*Always use a safely-grounded wrist strap (provided with your instrument) when installing modules in the mainframe, handling modules, or making connections. Discharge cables to ground before attaching them to modules.*

## Compensate the Mainframe

### 1. Select **Utilities > Compensation**.

The Compensation dialog box lists the main instrument and sampling modules. The temperature change from the last compensation is also listed as shown in the following figure.

2. Wait until the Status for all items to compensate changes from **Warm Up** to Pass, Fail, or Comp Req'd.
3. Click **Compensate and Save** (in Select Action area).

4. Click the **Compensate Target** button (below the **Select Action** area) and select **Mainframe**.
5. Click **Execute** to begin the mainframe compensation.
6. Follow on-screen instructions to disconnect inputs and install terminations; be sure to follow static precautions (see the user manual for your sampling module) when following these instructions. The compensation may take several minutes to complete.
7. Verify that **Pass** appears as Status for the main instrument when compensation completes. If instead **Fail** appears as Status, rerun the compensation. If **Fail** status continues after rerunning compensation and you have allowed warm-up to occur, the main instrument may need service.
8. Click the **Close** button to exit, or continue to the next section to compensate installed modules. (See page 1-5, *Compensate the Modules*.)

### Compensate the Modules

1. Wait until the Status for all items to compensate changes from **Warm Up** to **Pass**, **Fail**, or **Comp Req'd**.
2. Click **Compensate and Save** (in **Select Action** area).
3. Click the **Compensate Target** button (below the **Select Action** area) and select **All Modules**.
4. Click **Execute** to begin module compensation.
5. Follow on-screen instructions to disconnect inputs and install terminations, while leaving trigger signals connected to the mainframe. Follow static precautions (see the user manual for your sampling module) when connecting or disconnecting terminations and cables. The compensation may take several minutes to complete.



**CAUTION.** *Failing to install the 50  $\Omega$  terminations on 80EXX-Series sampling-module input connectors during compensation can cause compensation failure messages or incorrect compensation settings.*

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**NOTE.** *If you do not have typical trigger signals to apply to the instrument for doing this performance verification, leave the **CLOCK INPUT/PRESCALE TRIGGER** and **TRIGGER DIRECT INPUT** connectors unterminated.*

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6. Verify that **Pass** appears as Status for each module when compensation completes. If instead **Fail** appears as Status, rerun the compensation. If **Fail** status continues after rerunning compensation and you have allowed warm-up to occur, move the module to another slot and run the compensation again (use the **Utilities > View/Change Module Config** tool, available on TekScope SW version 6.0.124 and greater to move the module while the instrument is

powered on, or power down the instrument and move the module to another slot). If the module continues to fail, the indicated module may need service.

7. Click the **Close** button to exit.

*End of Mainframe and Module Compensation Procedure*

Instrument Functional Tests

These procedures use the DC CALIBRATION OUTPUT and the TDR CLOCK OUTPUT connectors to further verify that the instrument functions properly. An SMA cable is required to do these test procedures. The equipment required is intentionally kept to a minimum.

**NOTE.** *These procedures verify that the instrument features operate. They do not verify that they operate within limits; therefore, do not interpret any quantities cited (such as "about five horizontal divisions") as limits.*

**NOTE.** *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 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, go back to step 1 and repeat the procedure.*

Verify Electrical Input Channels

Equipment required	One coaxial SMA cable, 50 $\Omega$ , 20 in (0.5 m), male-to-male (item 15)
Prerequisites	One electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, or 80E10)

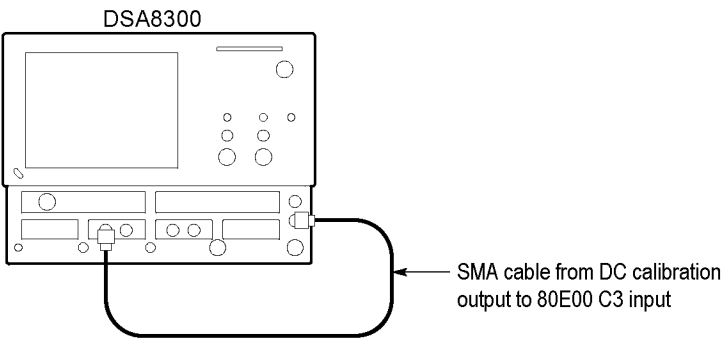
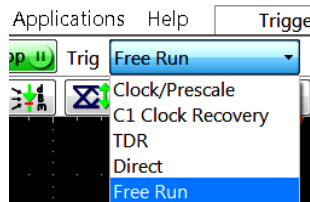


Figure 1-1: Setup for electrical functional tests



1. *Initialize the instrument:* Push the front-panel **DEFAULT SETUP** button and click **Yes** in the confirmation dialog box.
2. *Set the Trigger System:* In the UI application toolbar, select **Free Run** from the Trig menu.



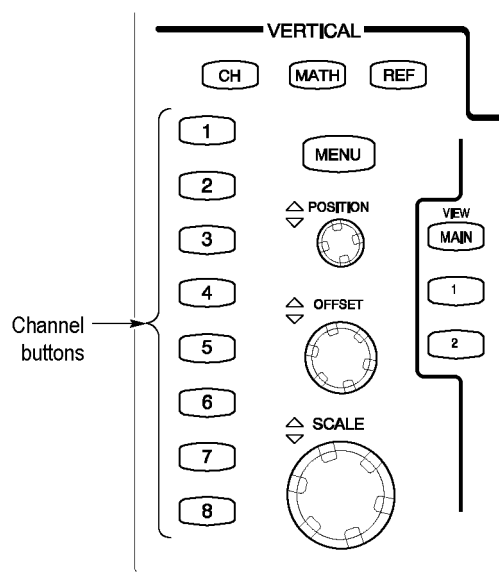
3. Connect the SMA cable from the DC CALIBRATION output to the channel input to test.
4. *Set the DC CALIBRATOR OUTPUT:*
  - a. Push the front-panel Vertical **MENU** button.

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**NOTE.** When an optical module is installed, the optical setup dialog box displays by default. Click the **Basic** button to display the basic dialog box.

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- b. Set the DC CAL value to **200 mV**.
  - c. Push the front-panel Vertical **MENU** button again to dismiss the Vert Setup dialog box.
5. Push the channel button for the channel to test. The button lights and the screen shows the selected channel signal.



**Figure 1-2: Channel button location**

6. *Confirm that the channel is operational:* Confirm that the following statements are true:
  - The vertical scale readout for the channel under test shows a setting of **100 mV**, and a DC level is at about 2 divisions above center screen.
  - The front-panel Vertical **OFFSET** knob (for the channel you are testing) moves the DC offset level up and down the screen when rotated. *Return the DC level to 2 divisions (0.0 V offset) above center screen before continuing.*
  - Turning the vertical **SCALE** knob to 50 mV changes the amplitude of the DC level to about 4 divisions above center screen, and returning the knob to 100 mV returns the amplitude to about 2 divisions above center screen.
7. *Confirm that the channel acquires in all acquisition modes:* Push the front-panel button **ACQUISITION MENU** to display the Acq Setup dialog box. Click each of the three 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 DC level).
  - Average mode displays an actively acquiring waveform on-screen with the noise reduced.
  - Envelope mode displays an actively acquiring waveform on-screen with the upper and lower extremes of the noise displayed.
8. Click the **Sample** acquisition mode.
9. *Confirm the DC accuracy compensation:* Do the following substeps:
  - a. Click the **Meas** tab in the Setups dialog box and set the following fields:
    - Select the source for the channel under test (lower half of the dialog box). For example, select **C3 on Main** for channel 3.
    - Click the Signal Type **Pulse** button (lower half of the dialog box).
    - Click the **Select Meas** button (top of dialog box) and select **Pulse - Amplitude > Mean**.
  - b. Click the **Vert** tab in the Setups dialog box.
  - c. Set the Scale, Offset, and DC Calibration Output fields to the values shown in the first row of the following table that applies to your module model.
  - d. Confirm that the Mean measurement readout value for the channel under test is within the limits shown in the table.
  - e. Repeat steps c and d for each row in the table for your module.

For the 80E01, 80E02, 80E03, 80E04, and 80E06

Vertical Scale (mV/div)	Vertical Offset (mV)	DC CAL Output (mV)	Limits	
			Minimum (V)	Maximum (V)
100	–1000.0	–1000.0	–1.0090	–.9910
100	0.0	–450	–461.0	–439.0
100	0.0	0	–2.0	2.0
100	0.0	450	439.0	461.0
100	1000.0	1000.0	991.0	1009.0

For the 80E07, 80E08, 80E09, and 80E10

Vertical Scale (mV/div)	Vertical Offset (mV)	DC CAL Output (mV)	Limits	
			Minimum (mV)	Maximum (mV)
100	–600.0	–600.0	–605.4	–594.6
100	0.0	–450	–461.0	–439.0
100	0.0	0	–2.0	2.0
100	0.0	450	439.0	461.0
100	600.0	600.0	594.6	605.4

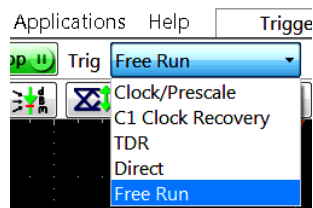
10. *Test all channels:* Repeat steps 3 through 9 until all input channels are verified.
11. *Remove the test setup:* Disconnect the SMA cable from the channel input and the DC CALIBRATION output.

## Verify Optical Input Channels

This verification is done without an input signal.

<b>Equipment required</b>	None
<b>Prerequisites</b>	At least one optical (80C00 series) sampling module must be installed.

1. *Initialize the instrument:* Push the front-panel DEFAULT SETUP button.
2. *Set the Trigger System:* In the UI application toolbar, select **Free Run** from the Trig menu.



3. *Select the channel to test:* Push the channel button for the channel to test. The button lights and the screen shows the selected channel signal.

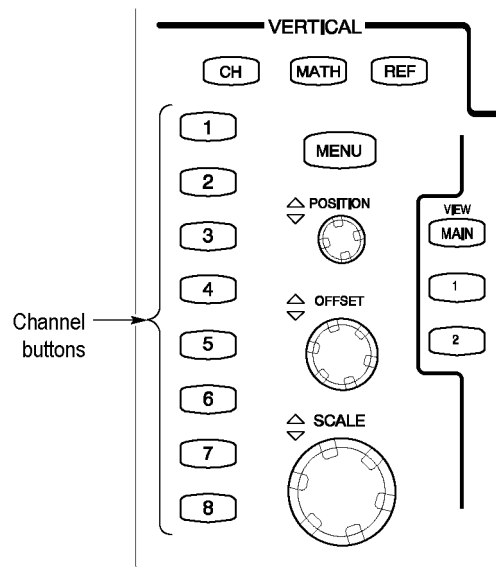


Figure 1-3: Channel button location

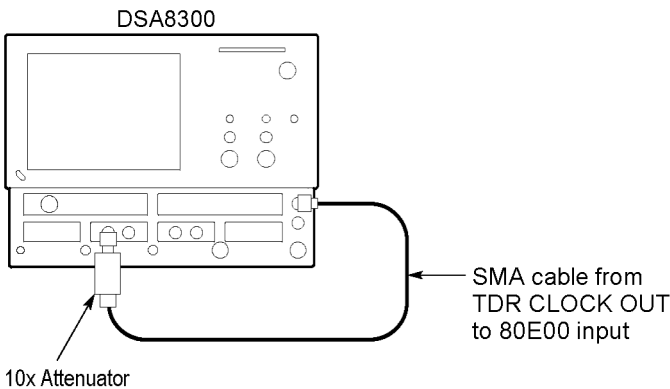
4. *Verify that the channel is operational:* Confirm that the following statements are true.
  - A trace displays at about center screen.
  - The Waveform readout for the channel under test shows a value as follows:
    - 80C01, 80C02, 80C04, 80C09, and 80C11: 1 mW
    - 80C03: 100  $\mu$ W
    - 80C05: 3 mW
    - 80C06: 6 mW
    - 80C07, and 80C07B: 100  $\mu$ W
    - 80C08, 80C08B, 80C08C and 80C12: 200  $\mu$ W
    - 80C10, 80C10B: 3 mW
    - 80C10B-F1, 80C25GBE: 2 mW
    - 80C14: 200  $\mu$ W
  - Rotating the front-panel Vertical **POSITION** knob (for the channel you are testing) moves the signal up and down the screen when rotated. *Return the baseline trace to center screen before continuing.*
  - Rotating the front-panel Vertical **OFFSET** knob counterclockwise offsets the baseline towards the bottom of the screen; turning the knob clockwise offsets the baseline towards the top of the screen. *Return the offset value to 0.0 (read the value in the Vertical Offset field along the bottom edge of the graticule).*
5. *Verify that the channel acquires in all acquisition modes:* Push the front-panel Acquisition **MENU** button to display the Acq Setup dialog box. Click each of the three acquisition modes and confirm that the following statements are true:
  - Sample mode displays an actively acquiring waveform on-screen. (Note that there may be a small amount of noise present on the baseline level).
  - Average mode displays an actively acquiring waveform on-screen with any noise present reduced.
  - Envelope mode displays an actively acquiring waveform on-screen with the upper and lower extremes of the noise displayed.Select **Sample** before continuing.
6. *Test all channels:* Repeat steps 3 through 5 to verify all optical input channels.
7. *Close Acquisition setup dialog box:* Push the Acquisition MENU button to close the Acq setup dialog box.

### Verify the Time Bases Work

After verifying the channels, you can now verify that the time bases function. This verification is done using a front-panel signal.

<b>Equipment required</b>	One SMA cable, 50 $\Omega$ , 20 in (0.5 m), male-to-male connectors (item 15) One 10x SMA attenuator (item 56) One electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, or 80E10)
<b>Prerequisites</b>	None

1. *Initialize the instrument:* Push the front-panel DEFAULT SETUP button.
2. *Hook up the signal source:* Connect the SMA cable from the TDR Clock output through a 10x attenuator to any 80E00 sampling module input channel as shown in the following figure.



**Figure 1-4: Setup for the time base tests**

3. *Set up the instrument:*
  - a. Push the Trigger **MENU** front-panel button to display the Mode/Trigger Setup dialog box.
  - b. Click **TDR** under **Trigger Source** in the Mode/Trigger Setup dialog box. The TDR Clock rate should be set to **200 kHz**.
  - c. Push the Trigger **MENU** front-panel button again to dismiss the Mode/Trigger dialog box.
  - d. Push the Vertical channel button for the channel you connected to in step 2.
  - e. Turn the Vertical **SCALE** knob to set the vertical scale to **20 mV/div**. The channel scale readout is displayed in the Control bar at the bottom of the graticule.

4. *Set the time base:* Set the Horizontal **SCALE** to **1  $\mu\text{s}/\text{div}$** . The horizontal scale readout is displayed in the Control bar at the bottom of the graticule.
  - a. Click **Setup > Display** in the main menu bar. In the Disp Setup dialog box, set the display Style to **Normal** and enable (check) **Show Vectors**.
  - b. Close the Setups dialog box.
  - c. Rotate the vertical **OFFSET** knob counterclockwise so that the base of the square wave is about 2 divisions below the center graticule. This is to ensure that a vertical trace will be seen for rise and fall.
5. *Verify that the Main time base operates:* Confirm that the following statements are true:
  - One period of the TDR clock waveform (a square wave) is about five horizontal divisions on-screen.
  - Rotating the Horizontal **SCALE** knob clockwise expands the waveform on-screen (more horizontal divisions per waveform period), counterclockwise rotation contracts it, and returning the horizontal scale to **1  $\mu\text{s}/\text{div}$**  returns the period to about five divisions. *Leave the time base set to 1  $\mu\text{s}/\text{div}$ .*
  - Rotating the horizontal **POSITION** knob moves the waveform left and right on the screen.

---

**NOTE.** *The signal will not move past the minimum position setting.*

---

6. *Set up the Mag1 time base:*
  - a. Push the Horizontal View **MAG1** front-panel button. The Mag1 time base view displays below the Main time base view.
  - b. Set the Horizontal **SCALE** to **1  $\mu\text{s}/\text{div}$** . The horizontal scale readout is in the Control bar at the bottom of the graticule and now shows the horizontal scale value of the Mag1 time base view.

7. *Verify that the Mag1 time base operates:* Confirm the following statements.

- The Mag view brackets on the Main View waveform (*top graticule*) are a full-screen width apart (10-divisions) as shown in the following figure.
- One period of the internal clock signal (a square wave) in the Mag view (*bottom graticule*) is about five horizontal divisions on-screen as shown in the following figure. (Matches the waveform in the top graticule.)
- Rotating the Horizontal **SCALE** knob clockwise to **500 ns/div** expands the waveform *in the bottom graticule* to double the period (about 10 horizontal divisions per waveform period); rotating the Horizontal SCALE knob counterclockwise returns the Horizontal scale setting to **1  $\mu$ s/div** returns the waveform period to about five divisions. Leave the Horizontal Scale set to **1  $\mu$ s/div**.

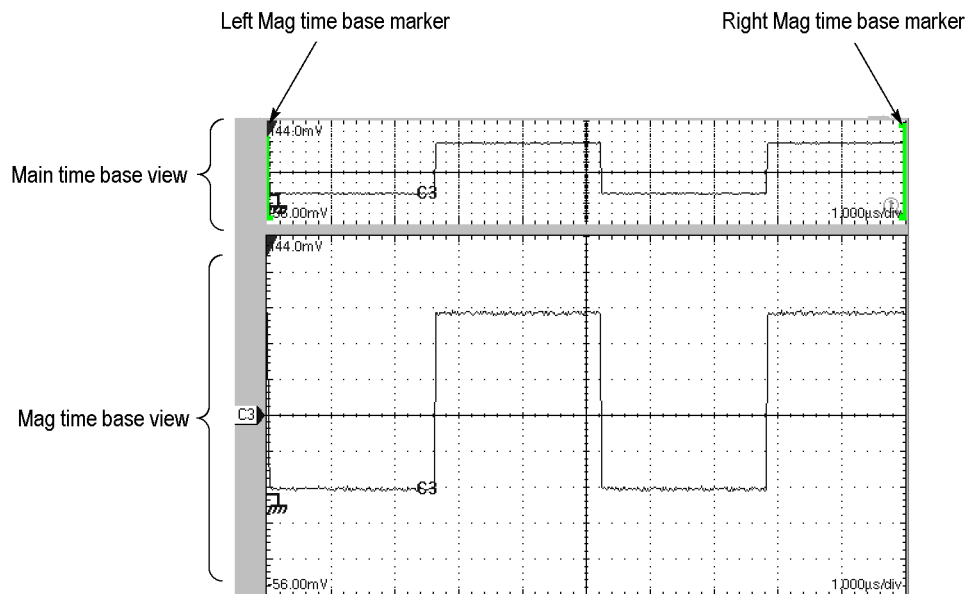


Figure 1-5: Mag time base verification

8. *Verify that the Mag2 time base operates:*

- a. Push the **Mag1** button to remove the display of the Mag1 time base.
- b. Perform steps 6 and 7, but use the Mag2 button instead of the Mag1.

---

**NOTE.** The color of the Mag2 brackets in the main view are different than those of the Mag1 brackets.

---



**Checking the Cooling Fan  
Operation**

<b>Equipment required</b>	None
<b>Prerequisites</b>	The instrument must be powered on and running.

Power on the instrument and verify that you can feel airflow from all six cooling fans on the left side of the instrument.

*End of Functional Test Procedures*

## Performance Tests

This chapter contains performance verification procedures for the specifications marked with the ✓ symbol. The equipment listed in the following table, or a suitable equivalent, is required to complete these procedures.

The procedures are arranged in sections:

- *Main Instrument (includes 82A04 Phase Reference Module)*
- *Electrical Sampling Modules*
- *Optical Sampling Modules*
- *80A02 EOS/ESD Protection Module*
- *80A05 Electrical Clock Recovery Module*

They check all the characteristics that are designated as checked in *Specifications*.

To check a system consisting of a main instrument and its modules:

- Perform the performance test procedures for the main instrument and then the installed modules.

To check a main instrument as an independent product:

- Do the main instrument tests using a two-channel 80E02, 80E03, 80E04, 80E07, 80E08, 80E09, or 80E10 module that has passed the tests in *80E00 Electrical Sampling Modules*. (See page 1-153, *Electrical Sampling Modules*.) When performing the time interval accuracy and external direct trigger delay jitter tests, check one channel of each small-module slot.
- In addition, to confirm that a main instrument can properly compensate all channels in all modules in all main instrument slots, do the *DC Voltage Measurement Accuracy* using the tested two-channel 80E00-series module. (See page 1-156, *DC Voltage Measurement Accuracy*.) Perform this check for each channel of each small-module slot.
- Be sure to run the instrument compensation routine with the tested module installed each time you move the module to a new slot.

To check a module as an independent product, do the tests for that module type using a main instrument that has passed the process just described for checking a main instrument as an independent product.

---

**NOTE.** *Checking the main instrument and modules as independent products verifies each product independently for all measured specifications, except for DC voltage accuracy of the main instrument and of 80E00 modules. The procedures do check that DC compensation is functioning properly, so it is highly probable that any combination of a main instrument and electrical module that passed testing as independent products will meet the system DC voltage accuracy specifications.*

*The Brief Procedures section of this manual includes a DC accuracy check to support verification by users that their specific combination of main instrument and electrical module meets system specifications. This test uses the main instrument DC Calibration Output and does not require external test generators.*

---

## 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 procedure *Perform the Diagnostics*, and the procedure *Perform the Functional Tests*. (See page 1-2, *Instrument Diagnostics*.) (See page 1-6, *Instrument Functional Tests*.)
- A compensation must have been done within the recommended calibration interval and at a temperature within  $\pm 2$  °C of the present operating temperature. (If, at the time you did the procedures *Perform the Diagnostics* and *Perform the Functional Tests*, you also did the *Perform the Compensation procedure* consider this prerequisite met). (See page 1-3, *Instrument and Module Compensation*.)
- 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.
- Observe all safety rules, especially regarding voltage hazards.

These procedures cover all instrument models. Please ignore checks that do not apply to the specific model you are testing.

## Equipment Required

The procedures mentioned in *Main Instruments* section use external, traceable signal sources to directly check warranted characteristics. (See page 1-129, *Main Instrument*.) The following table lists the required equipment.



**WARNING.** Some of the generator equipment used to complete the performance tests may be capable of producing dangerous output levels.

*Optical generators may cause eye damage. Electrical generators may produce a shock hazard.*

*Always turn generators to off or 0 before connecting and disconnecting from the test setup.*

*Observe all the manufacturer's safety information provided with the test equipment.*

**Table 1-1: Equipment required**

Item number and description	Minimum requirements	Part number or model
1. Adapter (80E01, 80E09, 80E10, and 80E06 only)	2.4 mm, male-to-male connectors	HP11900A
2. Adapter (80E01, 80E09, 80E10, and 80E06 only)	2.4 mm, female-to-female connectors	HP11900B
3. Adapter (Qty. 2)	SMA female to BNC male connectors	Tektronix part number 015-0572-00
4. Adapter (Qty. 2)	BNC to dual banana plugs	Tektronix part number 103-0090-00
5. Adapter	SMA "T" 1 male to 2 SMA female	Tektronix part number 015-1016-00
6. Attenuator (80E01 only)	10 dB, female to male SMA connectors	HP8490D with option 10
7. Attenuator	2X attenuator 50 $\Omega$ SMA connectors	Tektronix part number 015-1001-00
8. Attenuator, optical	30 mm, 10 dB, single-mode, FC to FC, female to male	Tektronix part number 119-5118-00
9. Airline (80E04 and 80E08 only)	50 $\Omega$ , airline, 3.5 mm connectors, 10 cm line	Maury Microwave model number 8042D
10. Airline (80E10 only)	50 $\Omega$ , precision airline, 2.4 mm connectors	Maury Microwave model number 7943G
11. Cable, delay, coaxial	Coaxial cable, 50 $\Omega$ , 500 ps, with 3.5 mm, male each end, 6.0 inch length	Tektronix part number 015-0564-00
12. Cable, delay, coaxial	Coaxial cable, 50 $\Omega$ , 2 ns delay, with SMA male each end	Tektronix part number 015-0560-00
13. Cable, fiber-optic (Qty.2)	Single-mode, 2 m, FC/PC to FC/PC	Tektronix part number 174-1910-00
14. Cable, special (80E01 and 80E06 only)	Phase and power stability	Gore-Tex FE0BM0BM025.0

**Table 1-1: Equipment required (cont.)**

<b>Item number and description</b>	<b>Minimum requirements</b>	<b>Part number or model</b>
15. Cable, coaxial (Qty. 2)	50 $\Omega$ , 20 in (0.5 m), male-to-male SMA connectors	Tektronix part number 174-1427-00
16. Cable, coaxial	50 $\Omega$ , 39.37 in (1.0 m), male-to-male SMA connectors	Tektronix part number 174-1341-00
	50 $\Omega$ , 60 in (1.5 m), male-to-male SMA connectors	Tektronix part number 174-1428-00
17. Cable, Precision 50 $\Omega$ Coaxial (80E06 only)	50 $\Omega$ , 36 in, male-to-male BNC connectors	Tektronix part number 012-0482-00
18. Digital multimeter	Four wire ohm meter. <0.25% accuracy for volt and ohm measurements	Keithley 2000-20
19. DC power supply	Variable amplitude to $\pm 104$ V; accuracy to 0.1%	Data Precision 8200
20. Laser transmitter	2.5 Gb/s SONET/SDH laser transmitter	JDS Uniphase Model 420B
21. Optical attenuator, variable	Single-mode input and output, 0 to 60 dB	Tektronix part number OA5002
22. Optical Impulser	1550 nm impulse	Calmar FPL-01 Optical Impulser
23. Optical Wavelength Meter	0.001 nm resolution	Advantest Q8326
24. Power meter (80E01, 80E06, 80E07, 80E08, 80E09, and 80E10 only)	Power meter	Anritsu-Wilton ML2437A
25. Power sensor (80E01, 80E06, 80E07, 80E08, 80E09, and 80E10 only)	Power sensor w/attached cable	Anritsu-Wilton ML2425A
26. Power divider	50 $\Omega$ , 3 SMA female connectors	Tektronix part number 015-0565-00
27. Short, coaxial	Shorting, 34 GHz, precision 3.5 mm, female	Tektronix part number 011-0150-00
28. Terminator	50 $\Omega$ coaxial terminator, K male	Anritsu-Wiltron 28K50
29. Terminator (80E10 only)	50 $\Omega$ coaxial terminator, V male	Anritsu-Wiltron 28V50B
30. Short, coaxial	Coaxial, short circuit 3.5 mm, SMA male	Tektronix part number 015-1020-00
31. Synthesized signal generator	Signal generator 50 MHz to 50 GHz	Anritsu-Wiltron 69187B
32. Sampling module	Tektronix 80C02 Sampling Module	Tektronix 80C02 Sampling Module
33. Photodetector	>1 GHz bandwidth	Picomatrix P-15B
34. Polarization-maintaining fiber coupler	Polarization Isolation <-24 dB	CIRL Model 904P (50/50)
35. Polarization-maintaining fiber coupler	Polarization Isolation <-24 dB	CIRL Model 904PS (5/95)
36. PM fiber jumper cable	FC/APC and FC/PC connector	Tempo-Camarillo part number 2M2L-1P5-1.5
37. SMA fiber jumper cable	FC/APC and FC/PC connector	Fiber Instrument Sales, Inc., part number S3-77AS-1.5-FIS
38. Pulse pattern generator	>12.5 Gb/s pulse pattern generator	Advantest D3186 12 Gb/s Pulse Pattern Generator

Table 1-1: Equipment required (cont.)

Item number and description	Minimum requirements	Part number or model
39. Terminator, coaxial	Coaxial terminator, 50 $\Omega$ 0.5 W, SMA male	Tektronix part number 015-1022-01
40. Real-time oscilloscope	500 MHz bandwidth	Tektronix TDS3052 or TDS3054
41. Tunable ECL laser (Qty. 2)	See <i>Tunable Laser Requirements</i> on page 2-187	New Focus tunable ECL lasers (2), Model 6528-HP or 6538-HP
42. Scalar Network Analyzer (80E06, 80E07, 80E08, 80E09, and 80E10 only)	10 MHz to 50 GHz. Must use specified equipment	Anritsu 54177A
43. SWR Autotester (80E06, 80E07, 80E08, 80E09, and 80E10 only)	10 MHz to 50 GHz. Must use specified equipment	Anritsu 560-98V5
44. Reflectometer (80E06 and 80E09 only)	50 GHz to 65 GHz. Must use specified equipment	Oleson R15RFT (specify OML DC power cable to dual banana plug)
45. Power meter (80E06, 80E07, 80E08, 80E09, and 80E10 only)	Must use specified equipment	Agilent E4417A Power Meter
46. Power sensor (80E06 and 80E09 only)	50 MHz to 50 GHz. Must use specified equipment	Agilent 8487A Power Sensor, 2002-07-31
47. RF Power Detector (80E06, 80E07, 80E08, 80E09, and 80E10 only)	10 MHz to 50 GHz. Must use specified equipment	Anritsu RF Detector, 560-7VA50
48. Power sensor (80E06 and 80E09 only)	Waveguide Power Sensor. Must use specified equipment	Agilent V8486A
49. Open/Short (80E06, 80E07, 80E08, 80E09, and 80E10 only)	DC to 50 GHz. Must use specified equipment	Anritsu 22V50 Open and Short
50. Short (80E10 only)	Short	Anritsu 23V50-5.1 V short
51. Adapter (80E06 and 80E09 only)	WR15 (Waveguide)-to-1.85 mm male connectors, 50 GHz to 65 GHz. Must use specified equipment	Anritsu 35WR15V
52. Adapter (80E06 and 80E09 only)	WR15 (Waveguide)-to-1.85 mm female connectors, 50 GHz to 65 GHz. Must use specified equipment	Anritsu 35WR15VF
53. Waveguide section (80E06 and 80E09 only)	Straight section, 50 GHz to 75 GHz, 4 inch length, round flanged. Must use specified equipment	Millitech SRW-15-RO400
54. Attenuator (80E06, 80E07, 80E08, 80E09, and 80E10 only) (Qty. 2)	6 dB attenuator, DC to 50 GHz, 2.4 mm connectors	Agilent 8490D, option 006
55. 80N01 Module Extender (2 meter)	Extender cable for use with certain small compartment modules	Tektronix 80N01 module extender
56. Attenuator (80A05 only) (Qty. 2)	10X (20 dB), female to male SMA connectors	Tektronix part number 015-1003-00
57. Stereo mini phono plug (80A02 only)	Stereo phono mine-plug with exposed connections	Common part, obtain by description
58. Adapter	SMA adapter, female to female	Tektronix part number 015-1012-00

## DSA8300 Digital Serial Analyzer Test Records

This section contains test records that you can use to record the results of your performance verification checks.

- *DSA8300 Main Instrument (includes 82A04 Phase Reference module)*
- *80E00 Electrical Sampling Modules*
- *80C00 Optical Sampling Modules*
- *80A02 EOS/ESD Protection Module*
- *80A05 Electrical Clock Recovery Module*

Do not enter values into the records contained in this manual; rather, make copies of the records and enter test results on the copies.

The test records provide entries for all checks found in the *Performance Tests* procedures.

## DSA8300 Main Instrument and 82A04 Module Test Record

For each channel tested, photocopy this and the next page, and record the performance test results for the main-instrument test record.

**DSA8300 and 82A04 Test Record Channel:** \_\_\_\_\_.

Instrument Serial Number:			Certificate Number:		
Date of Calibration:			Technician:		
82A04 Module Serial Number:			Module Certificate Number:		
Date of Calibration:			Technician:		
<b>Performance Test</b>			<b>Minimum</b>	<b>Incoming</b>	<b>Outgoing</b>
<i>Time Interval Accuracy, Trigger Direct Input connector</i>					
Horizontal Position	Set to:	19 ns <sup>1</sup>	0.991 ns		1.009 ns
		100 ns	0.991 ns		1.009 ns
		1 $\mu$ s	0.991 ns		1.009 ns
<i>Time Interval Accuracy, Clock Input/Prescale Trigger connector; Eye mode</i>					
Horizontal Position	Set to:	19 ns <sup>1</sup>	0.991 ns		1.009 ns
		100 ns	0.991 ns		1.009 ns
		1 $\mu$ s	0.991 ns		1.009 ns
<i>Time Interval Accuracy, Clock Input/Prescale Trigger connector; Other mode</i>					
Horizontal Position	Set to:	19 ns <sup>1</sup>	0.991 ns		1.009 ns
		100 ns	0.991 ns		1.009 ns
		1 $\mu$ s	0.991 ns		1.009 ns
<i>External Trigger Direct Input connector delay jitter</i>					
Horizontal Position	Set to:	19 ns <sup>1</sup>	none		<1.5 ps
		100 ns	none		<2.5 ps
		1 $\mu$ s	none		<11.5 ps
<i>Trigger delay jitter, Untriggered phase corrected mode (with 82A04 module only)</i>					
Horizontal Position	Set to:	20 ns <sup>1</sup>	none		$\leq$ 200 fs, typical
<i>Trigger delay jitter, external triggered phase corrected mode- Clock Eye (with 82A04 module only)</i>					



Performance Test				Minimum	Incoming	Outgoing	Maximum
Horizontal Position	Set to:	20 ns <sup>1</sup>		none			≤200 fs, typical
<i>External Clock/Prescale trigger delay jitter</i>							
Horizontal Position	Set to:	20 ns <sup>1</sup>		none			<500 fs
				none			<1.4 ps
<i>DC Calibration Output</i>							
	Set to:	+1.0 V		+0.9988 V			+1.0012 V
		0.0 V		−0.2 mV			+0.2 mV
		−1.0 V		−1.0012 V			−0.9988 V

<sup>1</sup> 29 ns for 80E07, 80E08, 80E09, 80E10

## 80E00 Electrical Modules Test Record

Photocopy this table for each 80E00 module being tested. Use them to record the performance test results for your Test Record.

Note that the C1 and C2 designations (channel 1/channel 2) in the test record may become C3/C4, C5/C6, or C7/C8, depending on which compartment in the main instrument the module is installed in.

### 80E00 Test Record.

Module Model:

Module Serial Number:

Certificate Number:

Date of Calibration:

Technician:

Performance test				Minimum	Incoming	Outgoing	Maximum
<i>Input Impedance</i>							
80E01	C1	Impedance		49.5 Ω			50.5 Ω
80E02	Baseline (80E04 only)			−1 mV			1 mV
80E03	C2	Impedance		49.5 Ω			50.5 Ω
80E06	Baseline (80E04 only)			−1 mV			1 mV
80E07	C1	Impedance		49 Ω			51 Ω
80E08	C2	Impedance		49 Ω			51 Ω
80E09							
80E10							

*DC Voltage accuracy, single point, within ±5 °C of compensated temperature*

Performance test		Minimum	Incoming	Outgoing	Maximum
80E01	C1 @ 100 mV/div				
80E02					
80E03					
80E04					
80E06					
		Input level:	Offset:		
		-1550 mV	-1100 mV	-18.7 mV	+18.7 mV
		-1350 mV	-1100 mV	-14.7 mV	+14.7 mV
		-1100 mV	-1100 mV	-9.7 mV	+9.7 mV
		-850 mV	-1100 mV	-14.7 mV	+14.7 mV
		-650 mV	-1100 mV	-18.7 mV	+18.7 mV
		-450 mV	0 mV	-11 mV	+11 mV
		-250 mV	0 mV	-7 mV	+7 mV
		0 mV	0 mV	-2 mV	+2 mV
		+250 mV	0 mV	-7 mV	+7 mV
		+450 mV	0 mV	-11 mV	+11 mV
		+650 mV	+1100 mV	-18.7 mV	+18.7 mV
		+850 mV	+1100 mV	-14.7 mV	+14.7 mV
		+1100 mV	+1100 mV	-9.7 mV	+9.7 mV
		+1350 mV	+1100 mV	-14.7 mV	+14.7 mV
		+1550 mV	+1100 mV	-18.7 mV	+18.7 mV
	C2 @ 100 mV/div				
		Input level:	Offset:		
		-1550 mV	-1100 mV	-18.7 mV	+18.7 mV
		-1350 mV	-1100 mV	-14.7 mV	+14.7 mV
		-1100 mV	-1100 mV	-9.7 mV	+9.7 mV
		-850 mV	-1100 mV	-14.7 mV	+14.7 mV
		-650 mV	-1100 mV	-18.7 mV	+18.7 mV
		-450 mV	0 mV	-11 mV	+11 mV
		-250 mV	0 mV	-7 mV	+7 mV
		0 mV	0 mV	-2 mV	+2 mV
		+250 mV	0 mV	-7 mV	+7 mV
		+450 mV	0 mV	-11 mV	+11 mV
		+650 mV	+1100 mV	-18.7 mV	+18.7 mV
		+850 mV	+1100 mV	-14.7 mV	+14.7 mV
		+1100 mV	+1100 mV	-9.7 mV	+9.7 mV
		+1350 mV	+1100 mV	-14.7 mV	+14.7 mV
		+1550 mV	+1100 mV	-18.7 mV	+18.7 mV



Performance test			Minimum	Incoming	Outgoing	Maximum
80E01	C1	Set the V <sub>in</sub> :				
80E02		-450 mV	-10 mV			+10 mV
80E03		-350 mV	-10 mV			+10 mV
80E04		-250 mV	-10 mV			+10 mV
80E06						
80E07						
80E08						
80E09						
80E10						
			-150 mV	-10 mV		
		-50 mV	-10 mV			+10 mV
		+50 mV	-10 mV			+10 mV
		+150 mV	-10 mV			+10 mV
		+250 mV	-10 mV			+10 mV
		+350 mV	-10 mV			+10 mV
		+450 mV	-10 mV			+10 mV
	C2	Set the V <sub>in</sub> :				
		-450 mV	-10 mV			+10 mV
		-350 mV	-10 mV			+10 mV
		-250 mV	-10 mV			+10 mV
		-150 mV	-10 mV			+10 mV
		-50 mV	-10 mV			+10 mV
		+50 mV	-10 mV			+10 mV
		+150 mV	-10 mV			+10 mV
		+250 mV	-10 mV			+10 mV
		+350 mV	-10 mV			+10 mV
		+450 mV	-10 mV			+10 mV
Random Noise Displayed						
80E01	C1	Vert scale: 2 mV	none			2.3 mV
80E02	C1	Vert scale: 1 mV	none			800 μV
	C2	Vert scale: 1 mV	none			800 μV
80E03	C1	Vert scale: 1 mV	none			1.2 mV
80E04	C2	Vert scale: 1 mV	none			1.2 mV
80E06	C1	Vert scale: 2 mV	none			2.4 mV

Performance test			Minimum	Incoming	Outgoing	Maximum
80E07 80E08	C1 (BW 30 GHz)	Vert scale: 1 mV	none			410 $\mu$ V
	C2 (BW 30 GHz)	Vert scale: 1 mV	none			410 $\mu$ V
	C1 (BW 20 GHz)	Vert scale: 1 mV	none			380 $\mu$ V
	C2 (BW 20 GHz)	Vert scale: 1 mV	none			380 $\mu$ V
80E09	C1 (BW 60 GHz)	Vert scale: 1 mV	none			600 $\mu$ V
	C2 (BW 60 GHz)	Vert scale: 1 mV	none			600 $\mu$ V
	C1 (BW 40 GHz)	Vert scale: 1 mV	none			480 $\mu$ V
	C2 (BW 40 GHz)	Vert scale: 1 mV	none			480 $\mu$ V
	C1 (BW 30 GHz)	Vert scale: 1 mV	none			410 $\mu$ V
	C2 (BW 30 GHz)	Vert scale: 1 mV	none			410 $\mu$ V
80E10	C1 (BW 50 GHz)	Vert scale: 1 mV	none			700 $\mu$ V
	C2 (BW 50 GHz)	Vert scale: 1 mV	none			700 $\mu$ V
	C1 (BW 40 GHz)	Vert scale: 1 mV	none			480 $\mu$ V
	C2 (BW 40 GHz)	Vert scale: 1 mV	none			480 $\mu$ V
	C1 (BW 30 GHz)	Vert scale: 1 mV	none			410 $\mu$ V
	C2 (BW 30 GHz)	Vert scale: 1 mV	none			410 $\mu$ V
<i>Analog Bandwidth</i>						
80E01	C1 (to 50 GHz)	Max power (50 MHz ref)	none			+3 dB
		Min power (50 MHz ref)	-3 dB			

Performance test			Minimum	Incoming	Outgoing	Maximum
80E06	C1 (to 65 GHz)	Max power (50 MHz ref)	none			+3 dB
		Min power (50 MHz ref)	-3 dB			
80E07 80E08	C1 (to 30 GHz)	Max power (50 MHz ref)	none			+3 dB
		Min power (50 MHz ref)	-3 dB			
	C2 (to 30 GHz)	Max power (50 MHz ref)	none			+3 dB
		Min power (50 MHz ref)	-3 dB			
80E09	C1 (to 60 GHz)	Max power (50 MHz ref)	none			+3 dB
		Min power (50 MHz ref)	-3 dB			
	C2 (to 60 GHz)	Max power (50 MHz ref)	none			+3 dB
		Min power (50 MHz ref)	-3 dB			
80E10	C1 (to 50 GHz)	Max power (50 MHz ref)	none			+3 dB
		Min power (50 MHz ref)	-3 dB			
	C2 (to 50 GHz)	Max power (50 MHz ref)	none			+3 dB
		Min power (50 MHz ref)	-3 dB			
TDR system reflected rise time (80E04, 80E08, 80E10 models only)						

Performance test			Minimum	Incoming	Outgoing	Maximum
80E04	C1	TDR Polarity set to +	none			35 ps
		TDR Polarity set to -	none			35 ps
	C2	TDR Polarity set to +	none			35 ps
		TDR Polarity set to -	none			35 ps
80E08	C1	TDR Polarity set to +	none			22 ps
		TDR Polarity set to -	none			22 ps
	C2	TDR Polarity set to +	none			22 ps
		TDR Polarity set to -	none			22 ps
80E10	C1	TDR Polarity set to +	none			16 ps
		TDR Polarity set to -	none			16 ps
	C2	TDR Polarity set to +	none			16 ps
		TDR Polarity set to -	none			16 ps
TDR system step response aberrations (80E04, 80E08, 80E10 models only)						
80E04	C1 positive polarity	zone: from -10 ns to -20 ps <sup>1</sup>	-3%			+3%
		zone: from 400 ps to 5 ns <sup>2</sup>	-3%			+3%

Performance test		Minimum	Incoming	Outgoing	Maximum
	C1 negative polarity	zone: from 5 ns on <sup>2</sup>	-1%		+1%
		zone: from -10 ns to -20 ps <sup>1</sup>	-3%		+3%
		zone: from 400 ps to 5 ns <sup>2</sup>	-3%		+3%
		zone: from 5 ns on <sup>2</sup>	-1%		+1%
	C2 positive polarity	zone: from -10 ns to -20 ps <sup>1</sup>	-3%		+3%
		zone: from 400 ps to 5 ns <sup>2</sup>	-3%		+3%
		zone: from 5 ns on <sup>2</sup>	-1%		+1%
	C2 negative polarity	zone: from -10 ns to -20 ps <sup>1</sup>	-3%		+3%
		zone: from 400 ps to 5 ns <sup>2</sup>	-3%		+3%
		zone: from 5 ns on <sup>2</sup>	-1%		+1%
80E08	C1 positive polarity	zone: from -10 ns to -20 ps <sup>1</sup>	-1%		+1%
		zone: from 14 ps to 150 ps <sup>2</sup>	-2%		+25%
		zone: from 150 ps to 400 ps <sup>2</sup>	-2%		+12%
		zone: from 400 ps to 5 ns <sup>2</sup>	-2%		+2%
		zone: from 5 ns to 100 ns <sup>2</sup>	-2%		+1%
		zone: from 100 ns to end <sup>2</sup>	-1%		+1%



Performance test		Minimum	Incoming	Outgoing	Maximum
C1 negative polarity	zone: from -10 ns to -20 ps <sup>1</sup>	-1%			+1%
	zone: from 14 ps to 150 ps <sup>2</sup>	-2%			+25%
	zone: from 150 ps to 400 ps <sup>2</sup>	-2%			+12%
	zone: from 400 ps to 5 ns <sup>2</sup>	-2%			+2%
	zone: from 5 ns to 100 ns <sup>2</sup>	-2%			+1%
	zone: from 100 ns to end <sup>2</sup>	-1%			+1%
C2 positive polarity	zone: from -10 ns to -20 ps <sup>1</sup>	-1%			+1%
	zone: from 14 ps to 150 ps <sup>2</sup>	-2%			+25%
	zone: from 150 ps to 400 ps <sup>2</sup>	-2%			+12%
	zone: from 400 ps to 5 ns <sup>2</sup>	-2%			+2%
	zone: from 5 ns to 100 ns <sup>2</sup>	-2%			+1%
	zone: from 100 ns to end <sup>2</sup>	-1%			+1%
80E08 C2 negative polarity	zone: from -10 ns to -20 ps <sup>1</sup>	-1%			+1%
	zone: from 14 ps to 150 ps <sup>2</sup>	-2%			+25%
	zone: from 150 ps to 400 ps <sup>2</sup>	-2%			+12%

Performance test			Minimum	Incoming	Outgoing	Maximum
80E10	C1 positive polarity	zone: from 400 ps to 5 ns <sup>2</sup>	-2%			+2%
		zone: from 5 ns to 100 ns <sup>2</sup>	-2%			+1%
		zone: from 100 ns to end <sup>2</sup>	-1%			+1%
		zone: from -10 ns to -20 ps <sup>1</sup>	-1%			+1%
		zone: from 14 ps to 150 ps <sup>2</sup>	-2%			+25%
		zone: from 150 ps to 400 ps <sup>2</sup>	-2%			+12%
		zone: from 400 ps to 5 ns <sup>2</sup>	-2%			+2%
	C1 negative polarity	zone: from 5 ns to 100 ns <sup>2</sup>	-2%			+1%
		zone: from 100 ns to end <sup>2</sup>	-1%			+1%
		zone: from -10 ns to -20 ps <sup>1</sup>	-1%			+1%
		zone: from 14 ps to 150 ps <sup>2</sup>	-2%			+25%
		zone: from 150 ps to 400 ps <sup>2</sup>	-2%			+12%
		zone: from 400 ps to 5 ns <sup>2</sup>	-2%			+2%
		zone: from 5 ns to 100 ns <sup>2</sup>	-2%			+1%
		zone: from 100 ns to end <sup>2</sup>	-1%			+1%

Performance test		Minimum	Incoming	Outgoing	Maximum
C2 positive polarity	zone: from -10 ns to -20 ps <sup>1</sup>	-1%			+1%
	zone: from 14 ps to 150 ps <sup>2</sup>	-2%			+25%
	zone: from 150 ps to 400 ps <sup>2</sup>	-2%			+12%
	zone: from 400 ps to 5 ns <sup>2</sup>	-2%			+2%
	zone: from 5 ns to 100 ns <sup>2</sup>	-2%			+1%
	zone: from 100 ns to end <sup>2</sup>	-1%			+1%
C2 negative polarity	zone: from -10 ns to -20 ps <sup>1</sup>	-1%			+1%
	zone: from 14 ps to 150 ps <sup>2</sup>	-2%			+25%
	zone: from 150 ps to 400 ps <sup>2</sup>	-2%			+12%
	zone: from 400 ps to 5 ns <sup>2</sup>	-2%			+2%
	zone: from 5 ns to 100 ns <sup>2</sup>	-2%			+1%
	zone: from 100 ns to end <sup>2</sup>	-1%			+1%

<sup>1</sup> Before step transition.

<sup>2</sup> After step transition.

## 80C00 Test Records

Photocopy the table for the 80C00 module being tested and record the performance verification test results in the table.

(See page 1-35, *80C01 Test Record*.)

(See page 1-37, *80C02 Test Record*.)

(See page 1-39, *80C03 Test Record*.)

(See page 1-42, *80C04 Test Record*.)

(See page 1-44, *80C05 Test Record*.)

(See page 1-46, *80C06 Test Record*.)

(See page 1-47, *80C07 Test Record*.)

(See page 1-49, *80C07B Test Record*.)

(See page 1-55, *80C08 Test Record*.)

(See page 1-57, *80C08B Test Record*.)

(See page 1-61, *80C08C Test Record*.)

(See page 1-67, *80C09 Test Record*.)

(See page 1-69, *80C10 Test Record*.)

(See page 1-71, *80C10B Test Record*.)

(See page 1-75, *80C11 Test Record*.)

(See page 1-81, *80C12 Test Record*.)

(See page 1-85, *80C12-10G Test Record*.)

(See page 1-90, *80C12B Test Record*.)

(See page 1-107, *80C12B-10G Test Record*.)

(See page 1-115, *80C14 Test Record*.)

(See page 1-125, *80C25BGE Test Record*.)

## 80C01 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
Dark level (C1 at 100 μW)					
OC-12/STM-4		−10 μW		+10 μW	
OC-48/STM-16		−10 μW		+10 μW	
OC-192/STM-64		−10 μW		+10 μW	
12.5 GHz		−10 μW		+10 μW	
20 GHz		−10 μW		+10 μW	
Vertical equivalent optical noise (C1 at 100 μW)					
	OC-12/STM-4	none		12 μW <sub>RMS</sub>	
	Clock Recovery	none		15 μW <sub>RMS</sub>	
	OC-48/STM-16	none		12 μW <sub>RMS</sub>	
	Clock Recovery	none		15 μW <sub>RMS</sub>	
	OC-192/STM-64	none		12 μW <sub>RMS</sub>	
	Clock Recovery	none		15 μW <sub>RMS</sub>	
	12.5 GHz	none		12 μW <sub>RMS</sub>	
	Clock Recovery	none		15 μW <sub>RMS</sub>	
	20 GHz	none		25 μW <sub>RMS</sub>	
	Clock Recovery	none		25 μW <sub>RMS</sub>	
Minimum optical bandwidth					
12.5 GHz bandwidth setting		12.5 GHz		none	
20 GHz bandwidth setting		20 GHz		none	
OC-12/STM-4 622 Mb/s Reference Receiver setting frequency response (dB)					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	−0.50		+0.50	
93.3	−0.11	−0.61		+0.39	
186.6	−0.45	−0.95		+0.05	
279.9	−1.02	−1.52		−0.52	
373.2	−1.86	−2.36		−1.36	
466.7	−3.00	−3.50		−2.50	
559.9	−4.51	−5.67		−3.35	
622.1	−5.71	−7.25		−4.17	
653.2	−6.37	−8.08		−4.66	
746.5	−8.54	−10.74		−6.35	

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
839.8	−10.93	−13.55			−8.31
933.1	−13.41	−16.41			−10.41
<b>OC-48/STM-16 2.488 Gb/s Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.50			+0.50
373.3	−0.11	−0.61			+0.39
746.5	−0.45	−0.95			+0.05
1119.7	−1.02	−1.52			−0.52
1493.1	−1.86	−2.36			−1.36
1866.3	−3.00	−3.50			−2.50
2239.5	−4.51	−5.67			−3.35
2488.3	−5.71	−7.25			−4.17
2612.8	−6.37	−8.08			−4.66
2986.0	−8.54	−10.74			−6.35
3359.3	−10.93	−13.55			−8.31
3732.6	−13.41	−16.41			−10.41
<b>OC192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1493.2	−0.11	−0.96			+0.74
2986.0	−0.45	−1.30			+0.40
4478.8	−1.02	−1.87			+0.17
5972.4	−1.86	−2.71			−1.01
7465.0	−3.00	−3.86			−2.16
8958.0	−4.51	−6.19			−2.83
9953.28	−5.71	−7.87			−3.55
10451.2	−6.37	−8.75			−3.99
11944.0	−8.54	−11.53			−5.56
13437.2	−10.93	−14.45			−7.41
14930.4	−13.41	−17.41			−9.41
<b>Recovered clock timing jitter (80C01-CR only)</b>					
<i>Rate</i>	<i>Horz scale</i>				
OC-12	500 ps	none			8 ps <sub>RMS</sub>
OC-48	100 ps	none			8 ps <sub>RMS</sub>

**80C02 Test Record**

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test	Minimum	Incoming	Outgoing	Maximum
<b>Dark level (C1 at 100 <math>\mu</math>W)</b>				
OC-192/STM-64	-10 $\mu$ W			+10 $\mu$ W
12.5 GHz	-10 $\mu$ W			+10 $\mu$ W
20 GHz	-10 $\mu$ W			+10 $\mu$ W
30 GHz	-10 $\mu$ W			+10 $\mu$ W
<b>Vertical equivalent optical noise (C1 at 100 <math>\mu</math>W)</b>				
OC-192/STM-64	none			10 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			12 $\mu$ W <sub>RMS</sub>
12.5 GHz	none			10 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			12 $\mu$ W <sub>RMS</sub>
20 GHz	none			15 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			20 $\mu$ W <sub>RMS</sub>
30 GHz	none			30 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			40 $\mu$ W <sub>RMS</sub>
<b>Minimum optical bandwidth</b>				
12.5 GHz bandwidth setting	12.5 GHz			none
20 GHz bandwidth setting	20 GHz			none
30 GHz bandwidth setting	28 GHz			none
<b>OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)</b>				
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>			
0.00	0.00	-0.85		+0.85
1493.2	-0.11	-0.96		+0.74
2986.0	-0.45	-1.30		+0.40
4478.8	-1.02	-1.87		+0.17
5972.4	-1.86	-2.71		-1.01
7465.0	-3.00	-3.86		-2.16
8958.0	-4.51	-6.19		-2.83
9953.28	-5.71	-7.87		-3.55
10451.2	-6.37	-8.75		-3.99
11944.0	-8.54	-11.53		-5.56
13437.2	-10.93	-14.45		-7.41
14930.4	-13.41	-17.41		-9.41

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Recovered clock timing jitter (80C02-CR only)</b>					
<i>Rate</i>	<i>Horz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>



## 80C03 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level (C1 at 5 <math>\mu</math>W)</b>					
FC1063		-500 nW			+500 nW
ENET2500 (GBE)		-500 nW			+500 nW
OC-48/STM-16		-500 nW			+500 nW
<b>Vertical equivalent optical noise (C1 at 5 <math>\mu</math>W)</b>					
	FC1063	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	ENET2500 (GBE)	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	OC-48/STM-16	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
<b>OC-48/STM-16 2.488 Gb/s Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
373.3	-0.11	-0.61			+0.39
746.5	-0.45	-0.95			+0.05
1119.7	-1.02	-1.52			-0.52
1493.1	-1.86	-2.36			-1.36
1866.3	-3.00	-3.50			-2.50
2239.5	-4.51	-5.67			-3.35
2488.3	-5.71	-7.25			-4.17
2612.8	-6.37	-8.08			-4.66
2986.0	-8.54	-10.74			-6.35
3359.3	-10.93	-13.55			-8.31
3732.6	-13.41	-16.41			-10.41
<b>ENET2500 (GBE) 2.50 Gb/s Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
375	-0.11	-0.61			+0.39
750	-0.45	-0.95			+0.05
1125	-1.02	-1.52			-0.52
1500	-1.86	-2.36			-1.36

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1875	-3.00	-3.50			-2.50
2250	-4.51	-5.67			-3.35
2500	-5.71	-7.25			-4.17
2625	-6.37	-8.08			-4.66
3000	-8.54	-10.74			-6.35
3375	-10.93	-13.55			-8.31
3750	-13.41	-16.41			-10.41

**ENET1250 (GBE) 1.25 Gb/s Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	-0.50		+0.50
187.5	-0.11	-0.61		+0.39
375	-0.45	-0.95		+0.05
562.5	-1.02	-1.52		-0.52
750	-1.86	-2.36		-1.36
937.5	-3.00	-3.50		-2.50
1125	-4.51	-5.67		-3.35
1250	-5.71	-7.25		-4.17
1312.5	-6.37	-8.08		-4.66
1500	-8.54	-10.74		-6.35
1687.5	-10.93	-13.55		-8.31
1875	-13.41	-16.41		-10.41

**FC1063 (1.0625 Gb/s) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	-0.50		+0.50
159.5	-0.11	-0.61		+0.39
318.9	-0.45	-0.95		+0.05
478.4	-1.02	-1.52		-0.52
637.9	-1.86	-2.36		-1.36
797.4	-3.00	-3.50		-2.50
956.8	-4.51	-5.67		-3.35
1063	-5.71	-7.25		-4.17
1116	-6.37	-8.08		-4.66
1275	-8.54	-10.74		-6.35
1435	-10.93	-13.55		-8.31
1595	-13.41	-16.41		-10.41

**Recovered clock timing jitter (80C03-CR only)**

Rate	Horz scale			
FC1063	200 ps	none		8 ps <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
GBE	200 ps	none			8 ps <sub>RMS</sub>
OC-48	100 ps	none			8 ps <sub>RMS</sub>
2.5 Gb/s	100 ps	none			8 ps <sub>RMS</sub>

## 80C04 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
Dark level (C1 at 100 μW)					
OC-192/STM-64		–10 μW		+10 μW	
10.664 Gb/s		–10 μW		+10 μW	
20 GHz		–10 μW		+10 μW	
30 GHz		–10 μW		+10 μW	
Vertical equivalent optical noise (C1 at 100 μW)					
	OC-192/STM-64	none		10 μW <sub>RMS</sub>	
	Clock Recovery	none		12 μW <sub>RMS</sub>	
	10.664 Gb/s	none		10 μW <sub>RMS</sub>	
	Clock Recovery	none		12 μW <sub>RMS</sub>	
	20 GHz	none		15 μW <sub>RMS</sub>	
	Clock Recovery	none		20 μW <sub>RMS</sub>	
	30 GHz	none		30 μW <sub>RMS</sub>	
	Clock Recovery	none		40 μW <sub>RMS</sub>	
Minimum optical bandwidth					
20 GHz bandwidth setting		20 GHz		none	
30 GHz bandwidth setting		28 GHz		none	
OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	–0.85		+0.85	
1493.2	–0.11	–0.96		+0.74	
2986.0	–0.45	–1.30		+0.40	
4478.8	–1.02	–1.87		+0.17	
5972.4	–1.86	–2.71		–1.01	
7465.0	–3.00	–3.86		–2.16	
8958.0	–4.51	–6.19		–2.83	
9953.28	–5.71	–7.87		–3.55	
10451.2	–6.37	–8.75		–3.99	
11944.0	–8.54	–11.53		–5.56	
13437.2	–10.93	–14.45		–7.41	
14930.4	–13.41	–17.41		–9.41	
10.66 Reference Receiver setting frequency response (dB)					

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1599.8	-0.11	-0.96			+0.74
3199.2	-0.45	-1.30			+0.40
4798.6	-1.02	-1.87			+0.17
6398.9	-1.86	-2.71			-1.01
7998.0	-3.00	-3.86			-2.16
9597.7	-4.51	-6.19			-2.83
10664.0	-5.71	-7.87			-3.55
11197.5	-6.37	-8.75			-3.99
12796.9	-8.54	-11.53			-5.56
14396.7	-10.93	-14.45			-7.41
15996.5	-13.41	-17.41			-9.41
<b>Recovered clock timing jitter (80C04-CR only)</b>					
<i>Rate</i>	<i>Horz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>

## 80C05 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
Dark level (C1 at 100 μW)					
OC-192/STM-64		–10 μW		+10 μW	
20 GHz		–30 μW		+30 μW	
30 GHz		–30 μW		+30 μW	
40 GHz		–30 μW		+30 μW	
Vertical equivalent optical noise (C1 at 100 μW)					
	OC-192/STM-64	none		15 μW <sub>RMS</sub>	
	Clock Recovery	none		15 μW <sub>RMS</sub>	
	20 GHz	none		25 μW <sub>RMS</sub>	
	Clock Recovery	none		25 μW <sub>RMS</sub>	
	30 GHz	none		35 μW <sub>RMS</sub>	
	Clock Recovery	none		35 μW <sub>RMS</sub>	
	40 GHz	none		70 μW <sub>RMS</sub>	
	Clock Recovery	none		70 μW <sub>RMS</sub>	
Minimum optical bandwidth					
20 GHz bandwidth setting		20 GHz		none	
30 GHz bandwidth setting		30 GHz		none	
40 GHz bandwidth setting		40 GHz		none	
OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	–0.85		+0.85	
1493.2	–0.11	–0.96		+0.74	
2986.0	–0.45	–1.30		+0.40	
4478.8	–1.02	–1.87		+0.17	
5972.4	–1.86	–2.71		–1.01	
7465.0	–3.00	–3.86		–2.16	
8958.0	–4.51	–6.19		–2.83	
9953.28	–5.71	–7.87		–3.55	
10451.2	–6.37	–8.75		–3.99	
11944.0	–8.54	–11.53		–5.56	
13437.2	–10.93	–14.45		–7.41	
14930.4	–13.41	–17.41		–9.41	

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Aberrations (peak-to-peak)</b>					
Filter or Bandwidth	OC-192/STM-64	none			5%
	20 GHz	none			10%
	30 GHz	none			10%
	40 GHz	none			15%

**80C06 Test Record**

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level (C1 at 200 <math>\mu</math>W)</b>					
50 GHz		-25 $\mu$ W			+25 $\mu$ W
<b>Vertical equivalent optical noise (C1 at 200 <math>\mu</math>W)</b>					
	50 GHz	none			192 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			192 $\mu$ W <sub>RMS</sub>
<b>Aberrations (peak-to-peak)</b>					
Bandwidth	50 GHz	none			10%



## 80C07 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
Dark level (C1 at 5 μW)					
OC-3/STM-1		–500 nW		+500 nW	
OC-12/STM-4		–500 nW		+500 nW	
OC-48/STM-16		–500 nW		+500 nW	
2 GHz		–500 nW		+500 nW	
Vertical equivalent optical noise (C1 at 5 μW)					
	OC-3/STM-1	none		1.0 μW <sub>RMS</sub>	
	Clock Recovery	none		1.0 μW <sub>RMS</sub>	
	OC-12/STM-4	none		1.0 μW <sub>RMS</sub>	
	Clock Recovery	none		1.0 μW <sub>RMS</sub>	
	OC-48/STM-16	none		1.5 μW <sub>RMS</sub>	
	Clock Recovery	none		1.5 μW <sub>RMS</sub>	
Minimum optical bandwidth					
2 GHz bandwidth setting		2.3 GHz		none	
OC-3/STM-1 (155 Mb/s) Reference Receiver setting frequency response					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	–0.50		+0.50	
23.3	–0.11	–0.61		+0.39	
46.65	–0.45	–0.95		+0.05	
69.98	–1.02	–1.52		–0.52	
93.3	–1.86	–2.36		–1.36	
116.7	–3.00	–3.50		–2.50	
140.0	–4.51	–5.67		–3.35	
155.5	–5.71	–7.25		–4.17	
163.3	–6.37	–8.08		–4.66	
186.6	–8.54	–10.74		–6.35	
209.9	–10.93	–13.55		–8.31	
233.3	–13.41	–16.41		–10.41	
OC-12/STM-4 (622 Mb/s) Reference Receiver setting frequency response (dB)					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	–0.50		+0.50	
93.3	–0.11	–0.61		+0.39	

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
186.6	−0.45	−0.95			+0.05
279.9	−1.02	−1.52			−0.52
373.2	−1.86	−2.36			−1.36
466.7	−3.00	−3.50			−2.50
559.9	−4.51	−5.67			−3.35
622.1	−5.71	−7.25			−4.17
653.2	−6.37	−8.08			−4.66
746.5	−8.54	−10.74			−6.35
839.8	−10.93	−13.55			−8.31
933.1	−13.41	−16.41			−10.41
<b>OC-48/STM-16 (2.488 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.50			+0.50
373.3	−0.11	−0.61			+0.39
746.5	−0.45	−0.95			+0.05
1119.7	−1.02	−1.52			−0.52
1493.1	−1.86	−2.36			−1.36
1866.3	−3.00	−3.50			−2.50
2239.5	−4.51	−5.67			−3.35
2488.3	−5.71	−7.25			−4.17
2612.8	−6.37	−8.08			−4.66
2986.0	−8.54	−10.74			−6.35
3359.3	−10.93	−13.55			−8.31
3732.6	−13.41	−16.41			−10.41
<b>Recovered clock timing jitter (80C07-CR only)</b>					
<i>Rate</i>	<i>Horz scale</i>				
OC-3	1 ns	none			32 ps <sub>RMS</sub>
OC-12	500 ps	none			8 ps <sub>RMS</sub>
OC-48	100 ps	none			4 ps <sub>RMS</sub>

## 80C07B Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level (C1 at 5 <math>\mu</math>W)</b>					
OC-3/STM-1		-500 nW			+500 nW
OC-12/STM-4		-500 nW			+500 nW
OC-48/STM-16		-500 nW			+500 nW
FC1063		-500 nW			+500 nW
FC2125		-500 nW			+500 nW
ENET1250		-500 nW			+500 nW
ENET2500		-500 nW			+500 nW
INFINIBAND		-500 nW			+500 nW
2.5 GHz		-500 nW			+500 nW
<b>Vertical equivalent optical noise</b>					
<b>1550 nm (C1 at 5 <math>\mu</math>W)</b>	OC-3/STM-1	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	OC-12/STM-4	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	OC-48/STM-16	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
	FC1063	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	FC2125	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
	ENET1250	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	ENET2500	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
	INFINIBAND	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
	2.5 GHz	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1310 nm (C1 at 5 $\mu$ W)	OC-3/STM-1	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	OC-12/STM-4	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	OC-48/STM-16	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
	FC1063	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	FC2125	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
	ENET1250	none			1.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.0 $\mu$ W <sub>RMS</sub>
	ENET2500	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
	INFINIBAND	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
	2.5 GHz	none			1.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.5 $\mu$ W <sub>RMS</sub>
850 nm (C1 at 5 $\mu$ W)	OC-3/STM-1	none			1.6 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.6 $\mu$ W <sub>RMS</sub>
	OC-12/STM-4	none			1.6 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.6 $\mu$ W <sub>RMS</sub>
	OC-48/STM-16	none			2.4 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			2.4 $\mu$ W <sub>RMS</sub>
	FC1063	none			1.6 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.6 $\mu$ W <sub>RMS</sub>
	FC2125	none			2.4 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			2.4 $\mu$ W <sub>RMS</sub>
	ENET1250	none			1.6 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			1.6 $\mu$ W <sub>RMS</sub>
	ENET2500	none			2.4 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			2.4 $\mu$ W <sub>RMS</sub>
	INFINIBAND	none			2.4 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			2.4 $\mu$ W <sub>RMS</sub>
	2.5 GHz	none			2.4 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			2.4 $\mu$ W <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
780 nm (C1 at 5 $\mu$ W)	OC-3/STM-1	none			2.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			2.0 $\mu$ W <sub>RMS</sub>
	OC-12/STM-4	none			2.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			2.0 $\mu$ W <sub>RMS</sub>
	OC-48/STM-16	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.0 $\mu$ W <sub>RMS</sub>
	FC1063	none			2.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			2.0 $\mu$ W <sub>RMS</sub>
	FC2125	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.0 $\mu$ W <sub>RMS</sub>
	ENET1250	none			2.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			2.0 $\mu$ W <sub>RMS</sub>
	ENET2500	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.0 $\mu$ W <sub>RMS</sub>
	INFINIBAND	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.0 $\mu$ W <sub>RMS</sub>
	2.5 GHz	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.0 $\mu$ W <sub>RMS</sub>
<b>Minimum optical bandwidth</b>					
2.5 GHz bandwidth setting		2.3 GHz			none
<b>OC-3/STM-1 (155 Mb/s) Reference Receiver setting frequency response</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
23.3	-0.11	-0.61			+0.39
46.65	-0.45	-0.95			+0.05
69.98	-1.02	-1.52			-0.52
93.3	-1.86	-2.36			-1.36
116.7	-3.00	-3.50			-2.50
140.0	-4.51	-5.67			-3.35
155.5	-5.71	-7.25			-4.17
163.3	-6.37	-8.08			-4.66
186.6	-8.54	-10.74			-6.35
209.9	-10.93	-13.55			-8.31
233.3	-13.41	-16.41			-10.41
<b>OC-12/STM-4 (622 Mb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
93.3	-0.11	-0.61			+0.39

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
186.6	-0.45	-0.95			+0.05
279.9	-1.02	-1.52			-0.52
373.2	-1.86	-2.36			-1.36
466.7	-3.00	-3.50			-2.50
559.9	-4.51	-5.67			-3.35
622.1	-5.71	-7.25			-4.17
653.2	-6.37	-8.08			-4.66
746.5	-8.54	-10.74			-6.35
839.8	-10.93	-13.55			-8.31
933.1	-13.41	-16.41			-10.41
<b>OC-48/STM-16 (2.488 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
373.3	-0.11	-0.61			+0.39
746.5	-0.45	-0.95			+0.05
1119.7	-1.02	-1.52			-0.52
1493.1	-1.86	-2.36			-1.36
1866.3	-3.00	-3.50			-2.50
2239.5	-4.51	-5.67			-3.35
2488.3	-5.71	-7.25			-4.17
2612.8	-6.37	-8.08			-4.66
2986.0	-8.54	-10.74			-6.35
3359.3	-10.93	-13.55			-8.31
3732.6	-13.41	-16.41			-10.41
<b>ENET2500 (2 GBE) (2.50 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
375	-0.11	-0.61			+0.39
750	-0.45	-0.95			+0.05
1125	-1.02	-1.52			-0.52
1500	-1.86	-2.36			-1.36
1875	-3.00	-3.50			-2.50
2250	-4.51	-5.67			-3.35
2500	-5.71	-7.25			-4.17
2625	-6.37	-8.08			-4.66
3000	-8.54	-10.74			-6.35
3375	-10.93	-13.55			-8.31
3750	-13.41	-16.41			-10.41

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>ENET1250 (GBE) 1.25 Gb/s Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
187.5	-0.11	-0.61			+0.39
375	-0.45	-0.95			+0.05
562.5	-1.02	-1.52			-0.52
750	-1.86	-2.36			-1.36
937.5	-3.00	-3.50			-2.50
1125	-4.51	-5.67			-3.35
1250	-5.71	-7.25			-4.17
1312.5	-6.37	-8.08			-4.66
1500	-8.54	-10.74			-6.35
1687.5	-10.93	-13.55			-8.31
1875	-13.41	-16.41			-10.41
<b>FC1063 (1.0625 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
159.5	-0.11	-0.61			+0.39
318.9	-0.45	-0.95			+0.05
478.4	-1.02	-1.52			-0.52
637.9	-1.86	-2.36			-1.36
797.4	-3.00	-3.50			-2.50
956.8	-4.51	-5.67			-3.35
1063	-5.71	-7.25			-4.17
1116	-6.37	-8.08			-4.66
1275	-8.54	-10.74			-6.35
1435	-10.93	-13.55			-8.31
1595	-13.41	-16.41			-10.41
<b>FC2125 (2.125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
318.8	-0.11	-0.61			+0.39
637.5	-0.45	-0.95			+0.05
956.3	-1.02	-1.52			-0.52
1275	-1.86	-2.36			-1.36
1594	-3.00	-3.50			-2.50
1913	-4.51	-5.67			-3.35
2125	-5.71	-7.25			-4.17

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
2231	−6.37	−8.08			−4.66
2550	−8.54	−10.74			−6.35
2869	−10.93	−13.55			−8.31
3188	−13.41	−16.41			−10.41
<b>INFINIBAND (2.5 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.50			+0.50
375	−0.11	−0.61			+0.39
750	−0.45	−0.95			+0.05
1125	−1.02	−1.52			−0.52
1500	−1.86	−2.36			−1.36
1875	−3.00	−3.50			−2.50
2250	−4.51	−5.67			−3.35
2500	−5.71	−7.25			−4.17
2625	−6.37	−8.08			−4.66
3000	−8.54	−10.74			−6.35
3375	−10.93	−13.55			−8.31
3750	−13.41	−16.41			−10.41
<b>Recovered clock timing jitter (80C07B-CR only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
OC-3/STM-1	1 ns	none			32 ps <sub>RMS</sub>
OC-12/STM-4	500 ps	none			8 ps <sub>RMS</sub>
OC-48/STM-16	100 ps	none			4 ps <sub>RMS</sub>
FC1063	200 ps	none			8 ps <sub>RMS</sub>
FC2125	100 ps	none			6 ps <sub>RMS</sub>
ENET1250	200 ps	none			8 ps <sub>RMS</sub>
ENET2500	100 ps	none			4 ps <sub>RMS</sub>
INFINIBAND	100 ps	none			4 ps <sub>RMS</sub>



**80C08 Test Record**

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level (C1 at 1 <math>\mu</math>W)</b>					
10 GHz		-1.0 $\mu$ W			+1.0 $\mu$ W
10GBASE-W		-1.0 $\mu$ W			+1.0 $\mu$ W
10GBASE-R		-1.0 $\mu$ W			+1.0 $\mu$ W
<b>Vertical equivalent optical noise</b>					
<b>1550 nm (C1 at 5 <math>\mu</math>W)</b>	10 GHz	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
<b>1310 nm (C1 at 5 <math>\mu</math>W)</b>	10 GHz	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
<b>850 nm (C1 at 5 <math>\mu</math>W)</b>	10 GHz	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
<b>780 nm (C1 at 5 <math>\mu</math>W)</b>	10 GHz	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
<b>Minimum optical bandwidth</b>					
10 GHz bandwidth setting		9.5 GHz			none
<b>10BASE-W (9.95328 Gb/s) Reference Receiver setting frequency response (dB)</b>					

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83
10000	−5.71	−7.87			−3.55
10500	−6.37	−8.75			−3.99
12000	−8.54	−11.53			−5.56
13500	−10.93	−14.45			−7.41
15000	−13.41	−17.41			−9.41
<b>10BASE-R (10.3125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83
10000	−5.71	−7.87			−3.55
10500	−6.37	−8.75			−3.99
12000	−8.54	−11.53			−5.56
13500	−10.93	−14.45			−7.41
15000	−13.41	−17.41			−9.41
<b>Recovered clock timing jitter (80C08-CR only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-W	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-R	20 ps	none			2 ps <sub>RMS</sub>

**80C08B Test Record**

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level (C1 at 1 <math>\mu</math>W)</b>					
10 GHz		-1.0 $\mu$ W			+1.0 $\mu$ W
10GBASE-W		-1.0 $\mu$ W			+1.0 $\mu$ W
10GBASE-R		-1.0 $\mu$ W			+1.0 $\mu$ W
OC-192/STM-64		-1.0 $\mu$ W			+1.0 $\mu$ W
10GFC		-1.0 $\mu$ W			+1.0 $\mu$ W
<b>Vertical equivalent optical noise</b>					
<b>1550 nm (C1 at 5 <math>\mu</math>W)</b>	10 GHz	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GFC	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
<b>1310 nm (C1 at 5 <math>\mu</math>W)</b>	10 GHz	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GFC	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>850 nm (C1 at 5 <math>\mu</math>W)</b>	10 GHz	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10GFC	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
<b>780 nm (C1 at 5 <math>\mu</math>W)</b>	10 GHz	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GFC	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
<b>Minimum optical bandwidth</b>					
10 GHz bandwidth setting		9.5 GHz			none
<b>10BASE-W (9.95328 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83
10000	−5.71	−7.87			−3.55
10500	−6.37	−8.75			−3.99
12000	−8.54	−11.53			−5.56
13500	−10.93	−14.45			−7.41
15000	−13.41	−17.41			−9.41
<b>10BASE-R (10.3125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41

#### OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)

Frequency (MHz)	Nominal response (dB)	
0.00	0.00	+0.85
1493.2	-0.11	+0.74
2986.0	-0.45	+0.40
4478.8	-1.02	+0.17
5972.4	-1.86	-1.01
7465.0	-3.00	-2.16
8958.0	-4.51	-2.83
9953.28	-5.71	-3.55
10451.2	-6.37	-3.99
11944.0	-8.54	-5.56
13437.2	-10.93	-7.41
14930.4	-13.41	-9.41

#### 10GFC (10.51875 Gb/s) Reference Receiver setting frequency response (dB)

Frequency (MHz)	Nominal response (dB)	
0.00	0.00	+0.85
1500	-0.11	+0.74
3000	-0.45	+0.40
4500	-1.02	+0.17
6000	-1.86	-1.01
7500	-3.00	-2.16
9000	-4.51	-2.83
10000	-5.71	-3.55
10500	-6.37	-3.99
12000	-8.54	-5.56

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
13500	–10.93	–14.45			–7.41
15000	–13.41	–17.41			–9.41
<b>Recovered clock timing jitter (80C08B-CR1 only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-W	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-R	20 ps	none			2 ps <sub>RMS</sub>
<b>Recovered clock timing jitter (80C08B-CR2 only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
10GBASE-R	20 ps	none			2 ps <sub>RMS</sub>
10GFC	20 ps	none			2 ps <sub>RMS</sub>

**80C08C Test Record**

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level (C1 at 1 <math>\mu</math>W)</b>					
10 GHz		-1.0 $\mu$ W			+1.0 $\mu$ W
10GBASE-W		-1.0 $\mu$ W			+1.0 $\mu$ W
10GBASE-R		-1.0 $\mu$ W			+1.0 $\mu$ W
OC-192/STM-64		-1.0 $\mu$ W			+1.0 $\mu$ W
10GFC		-1.0 $\mu$ W			+1.0 $\mu$ W
10GFC FEC		-1.0 $\mu$ W			+1.0 $\mu$ W
10GBE FEC		-1.0 $\mu$ W			+1.0 $\mu$ W
10.66 data filter		-1.0 $\mu$ W			+1.0 $\mu$ W
10.709 data filter		-1.0 $\mu$ W			+1.0 $\mu$ W
<b>Vertical equivalent optical noise</b>					
<b>1550 nm (C1 at 5 <math>\mu</math>W)</b>	10 GHz	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GFC	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GFC FEC	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBE FEC	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10.66 Gb/s	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10.709 Gb/s	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1310 nm (C1 at 5 $\mu$ W)	10 GHz	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GFC	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GFC FEC	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10GBE FEC	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10.66 Gb/s	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
	10.709 Gb/s	none			3.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			3.5 $\mu$ W <sub>RMS</sub>
850 nm (C1 at 5 $\mu$ W)	10 GHz	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.0 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			5.5 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10GFC	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10GFC FEC	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10GBE FEC	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10.66 Gb/s	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>
	10.709 Gb/s	none			5.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			5.5 $\mu$ W <sub>RMS</sub>



Instrument performance test		Minimum	Incoming	Outgoing	Maximum
780 nm (C1 at 5 $\mu$ W)	10 GHz	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GFC	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GFC FEC	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10GBE FEC	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10.66 Gb/s	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>
	10.709 Gb/s	none			6.0 $\mu$ W <sub>RMS</sub>
	Clock Recovery	none			6.6 $\mu$ W <sub>RMS</sub>

**Minimum optical bandwidth**

10 GHz bandwidth setting	9.5 GHz	none
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**10BASE-W (9.95328 Gb/s) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)	
0.00	0.00	-0.85
1500	-0.11	-0.96
3000	-0.45	-1.30
4500	-1.02	-1.87
6000	-1.86	-2.71
7500	-3.00	-3.86
9000	-4.51	-6.19
10000	-5.71	-7.87
10500	-6.37	-8.75
12000	-8.54	-11.53
13500	-10.93	-14.45
15000	-13.41	-17.41

**10BASE-R (10.3125 Gb/s) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)	
0.00	0.00	-0.85
1500	-0.11	-0.96

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)</b>					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	-0.85			+0.85
1493.2	-0.11	-0.96			+0.74
2986.0	-0.45	-1.30			+0.40
4478.8	-1.02	-1.87			+0.17
5972.4	-1.86	-2.71			-1.01
7465.0	-3.00	-3.86			-2.16
8958.0	-4.51	-6.19			-2.83
9953.28	-5.71	-7.87			-3.55
10451.2	-6.37	-8.75			-3.99
11944.0	-8.54	-11.53			-5.56
13437.2	-10.93	-14.45			-7.41
14930.4	-13.41	-17.41			-9.41
<b>10GFC (10.51875 Gb/s) Reference Receiver setting frequency response (dB)</b>					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>10GFC FEC (11.317 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10GBE FEC (11.0957 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10.66 Gb/s Data Filter frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
10500	−6.37	−8.75			−3.99
12000	−8.54	−11.53			−5.56
13500	−10.93	−14.45			−7.41
15000	−13.41	−17.41			−9.41
<b>10.709 Gb/s Data Filter frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83
10000	−5.71	−7.87			−3.55
10500	−6.37	−8.75			−3.99
12000	−8.54	−11.53			−5.56
13500	−10.93	−14.45			−7.41
15000	−13.41	−17.41			−9.41
<b>Recovered clock timing jitter (80C08C-CR1 only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-W	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-R	20 ps	none			2 ps <sub>RMS</sub>
<b>Recovered clock timing jitter (80C08C-CR2 only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
10GBASE-R	20 ps	none			2 ps <sub>RMS</sub>
10GFC	20 ps	none			2 ps <sub>RMS</sub>
<b>Recovered clock timing jitter (80C08C-CR4 only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-W	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-R	20 ps	none			2 ps <sub>RMS</sub>
10GFC	20 ps	none			2 ps <sub>RMS</sub>
10GBE	20 ps	none			2 ps <sub>RMS</sub>
G.975	20 ps	none			2 ps <sub>RMS</sub>
G.709	20 ps	none			2 ps <sub>RMS</sub>
Super FEC	20 ps	none			2 ps <sub>RMS</sub>

## 80C09 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test	Minimum	Incoming	Outgoing	Maximum
<b>Dark level (C1 at 100 <math>\mu</math>W)</b>				
OC-192/STM-64	-10 $\mu$ W			+10 $\mu$ W
10.71 Gb/s	-10 $\mu$ W			+10 $\mu$ W
20 GHz	-10 $\mu$ W			+10 $\mu$ W
30 GHz	-10 $\mu$ W			+10 $\mu$ W
<b>Vertical equivalent optical noise (C1 at 100 <math>\mu</math>W)</b>				
OC-192/STM-64	none			10 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			12 $\mu$ W <sub>RMS</sub>
10.71 Gb/s	none			10 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			12 $\mu$ W <sub>RMS</sub>
20 GHz	none			15 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			20 $\mu$ W <sub>RMS</sub>
30 GHz	none			30 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			40 $\mu$ W <sub>RMS</sub>
<b>Minimum optical bandwidth</b>				
20 GHz bandwidth setting	20 GHz			none
30 GHz bandwidth setting	28 GHz			none
<b>OC-192/STM-64 9.953 Gb/s Reference Receiver setting frequency response (dB)</b>				
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>			
0.00	0.00	-0.85		+0.85
1493.2	-0.11	-0.96		+0.74
2986.0	-0.45	-1.30		+0.40
4478.8	-1.02	-1.87		+0.17
5972.4	-1.86	-2.71		-1.01
7465.0	-3.00	-3.86		-2.16
8958.0	-4.51	-6.19		-2.83
9953.28	-5.71	-7.87		-3.55
10451.2	-6.37	-8.75		-3.99
11944.0	-8.54	-11.53		-5.56
13437.2	-10.93	-14.45		-7.41
14930.4	-13.41	-17.41		-9.41
<b>10.71 Gb/s Reference Receiver setting frequency response (dB)</b>				

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1606.6	−0.11	−0.96			+0.74
3212.8	−0.45	−1.30			+0.40
4819.0	−1.02	−1.87			+0.17
6426.0	−1.86	−2.71			−1.01
8032.0	−3.00	−3.86			−2.16
9638.4	−4.51	−6.19			−2.83
10709.2	−5.71	−7.87			−3.55
11245.0	−6.37	−8.75			−3.99
12851.1	−8.54	−11.53			−5.56
14457.7	−10.93	−14.45			−7.41
16064.4	−13.41	−17.41			−9.41
<b>Recovered clock timing jitter (80C09-CR1 only)</b>					
<i>Rate</i>	<i>Horz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>
FEC10.71 Gb/s	20 ps	none			2 ps <sub>RMS</sub>

## 80C10 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
Dark level					
1550 nm (C1 at 50 μW)	OC-768/STM-256	–25 μW			+25 μW
	FEC 43.02 Gb/s	–25 μW			+25 μW
	30 GHz	–25 μW			+25 μW
	65 GHz	–25 μW			+25 μW
1310 nm (C1 at 80 μW)	OC-768/STM-256	–35 μW			+35 μW
	FEC 43.02 Gb/s	–35 μW			+35 μW
	30 GHz	–35 μW			+35 μW
	65 GHz	–35 μW			+35 μW
Vertical equivalent optical noise					
1550 nm (C1 at 50 μW)	OC-768/STM-256	none			60 μW <sub>RMS</sub>
	FEC 43.02 Gb/s	none			60 μW <sub>RMS</sub>
	30 GHz	none			50 μW <sub>RMS</sub>
	65 GHz	none			120 μW <sub>RMS</sub>
1310 nm (C1 at 50 μW)	OC-768/STM-256	none			110 μW <sub>RMS</sub>
	43.02 Gb/s	none			110 μW <sub>RMS</sub>
	30 GHz	none			90 μW <sub>RMS</sub>
	65 GHz	none			220 μW <sub>RMS</sub>
Minimum optical bandwidth					
30 GHz bandwidth setting		30 GHz			none
65 GHz bandwidth setting		60 GHz			none
OC-768/STM-256 (39.813 Gb/s) Reference Receiver setting frequency response (dB)					
Frequency (GHz)	Nominal response (dB)				
0.00	0.00	–1.00			+1.00
5.97	–0.10	–1.10			+0.90
11.94	–0.45	–1.45			+0.55
17.92	–1.02	–2.02			–0.02
23.89	–1.86	–2.86			–0.86
29.86	–3.00	–4.00			–2.00
35.83	–4.51	–6.56			–2.46
39.81	–5.71	–8.37			–3.05
41.80	–6.37	–9.31			–3.43

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
47.78	−8.54	−12.26			−4.83
53.75	−10.93	−15.32			−6.53
59.72	−13.41	−18.41			−8.41
<b>FEC 43.02 Gb/s G.709 FEC Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (GHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−1.00			+1.00
6.45	−0.10	−1.10			+0.90
12.90	−0.45	−1.45			+0.55
19.36	−1.02	−2.02			−0.02
25.81	−1.86	−2.86			−0.86
32.26	−3.00	−4.00			−2.00
38.71	−4.51	−6.56			−2.46
43.02	−5.71	−8.37			−3.05
45.17	−6.37	−9.31			−3.43
51.63	−8.54	−12.26			−4.83
58.08	−10.93	−15.32			−6.53
64.53	−13.41	−18.41			−8.41
<b>Aberrations (peak to peak)</b>					
<b>Filter or bandwidth</b>	OC-768	none			5%
	FEC 43.02 Gb/s	none			5%
	30 GHz	none			5%
	65 GHz	none			10%



## 80C10B Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level</b>					
<b>1550 nm (C1 at 50 <math>\mu</math>W)</b>	OC-768/STM-256	-25 $\mu$ W			+25 $\mu$ W
	FEC 43.02 Gb/s	-25 $\mu$ W			+25 $\mu$ W
	40GBase-FR	-25 $\mu$ W			+25 $\mu$ W
	100GBase-R4	-25 $\mu$ W			+25 $\mu$ W
	100GBase-R4 FEC	-25 $\mu$ W			+25 $\mu$ W
	30 GHz	-25 $\mu$ W			+25 $\mu$ W
	65 GHz	-25 $\mu$ W			+25 $\mu$ W
	80 GHz	-25 $\mu$ W			+25 $\mu$ W
<b>1310 nm (C1 at 80 <math>\mu</math>W)</b>	OC-768/STM-256	-35 $\mu$ W			+35 $\mu$ W
	FEC 43.02 Gb/s	-35 $\mu$ W			+35 $\mu$ W
	40GBase-FR	-35 $\mu$ W			+35 $\mu$ W
	100GBase-R4	-35 $\mu$ W			+35 $\mu$ W
	100GBase-R4 FEC	-35 $\mu$ W			+35 $\mu$ W
	30 GHz	-35 $\mu$ W			+35 $\mu$ W
	65 GHz	-35 $\mu$ W			+35 $\mu$ W
	80 GHz	-35 $\mu$ W			+35 $\mu$ W
<b>Vertical equivalent optical noise</b>					
<b>1550 nm (C1 at 50 <math>\mu</math>W)</b>	OC-768/STM-256	none			38 $\mu$ W <sub>RMS</sub>
	FEC 43.02 Gb/s	none			38 $\mu$ W <sub>RMS</sub>
	40GBase-FR	none			38 $\mu$ W <sub>RMS</sub>
	100GBase-R4	none			28 $\mu$ W <sub>RMS</sub>
	100GBase-R4 FEC	none			28 $\mu$ W <sub>RMS</sub>
	30 GHz	none			35 $\mu$ W <sub>RMS</sub>
	65 GHz	none			60 $\mu$ W <sub>RMS</sub>
	80 GHz	none			105 $\mu$ W <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>1310 nm (C1 at 50 <math>\mu</math>W)</b>	OC-768/STM-256	none			50 $\mu$ W <sub>RMS</sub>
	43.02 Gb/s	none			50 $\mu$ W <sub>RMS</sub>
	40GBase-FR	none			50 $\mu$ W <sub>RMS</sub>
	100GBase-R4	none			38 $\mu$ W <sub>RMS</sub>
	100GBase-R4 FEC	none			38 $\mu$ W <sub>RMS</sub>
	30 GHz	none			45 $\mu$ W <sub>RMS</sub>
	65 GHz	none			75 $\mu$ W <sub>RMS</sub>
	80 GHz	none			130 $\mu$ W <sub>RMS</sub>
<b>Minimum optical bandwidth</b>					
30 GHz bandwidth setting		30 GHz			none
65 GHz bandwidth setting		60 GHz			none
80 GHz bandwidth setting		75 GHz			none
<b>OC-768/STM-256 (39.813 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (GHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	–1.00			+1.00
5.97	–0.10	–1.10			+0.90
11.94	–0.45	–1.45			+0.55
17.92	–1.02	–2.02			–0.02
23.89	–1.86	–2.86			–0.86
29.86	–3.00	–4.00			–2.00
35.83	–4.51	–6.56			–2.46
39.81	–5.71	–8.37			–3.05
41.80	–6.37	–9.31			–3.43
47.78	–8.54	–12.26			–4.83
53.75	–10.93	–15.32			–6.53
59.72	–13.41	–18.41			–8.41
<b>FEC 43.02 Gb/s G.709 FEC Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (GHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	–1.00			+1.00
6.45	–0.10	–1.10			+0.90
12.90	–0.45	–1.45			+0.55
19.36	–1.02	–2.02			–0.02
25.81	–1.86	–2.86			–0.86
32.26	–3.00	–4.00			–2.00
38.71	–4.51	–6.56			–2.46
43.02	–5.71	–8.37			–3.05
45.17	–6.37	–9.31			–3.43
51.63	–8.54	–12.26			–4.83

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
58.08	-10.93	-15.32			-6.53
64.53	-13.41	-18.41			-8.41
<b>40GBase-FR (41.25 Gb/s, ENET41250) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
6000	-0.11	-0.96			+0.74
12000	-0.45	-1.30			+0.40
18000	-1.02	-1.87			+0.17
24000	-1.86	-2.71			-1.01
30000	-3.00	-3.86			-2.16
36000	-4.51	-6.19			-2.83
40000	-5.71	-7.87			-3.55
42000	-6.37	-8.75			-3.99
48000	-8.54	-11.53			-5.56
54000	-10.93	-14.45			-7.41
60000	-13.41	-17.41			-9.41
<b>100GBase-R4 (25.781 Gb/s, ENET25781) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
3750	-0.11	-0.96			+0.74
7500	-0.45	-1.30			+0.40
11250	-1.02	-1.87			+0.17
15000	-1.86	-2.71			-1.01
18750	-3.00	-3.86			-2.16
22500	-4.51	-6.19			-2.83
25000	-5.71	-7.87			-3.55
26250	-6.37	-8.75			-3.99
30000	-8.54	-11.53			-5.56
33750	-10.93	-14.45			-7.41
37500	-13.41	-17.41			-9.41
<b>100GBase-R4 FEC (27.739 Gb/s, ENET27739) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
3750	-0.11	-0.96			+0.74
7500	-0.45	-1.30			+0.40
11250	-1.02	-1.87			+0.17
15000	-1.86	-2.71			-1.01
18750	-3.00	-3.86			-2.16

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
22500	−4.51	−6.19			−2.83
25000	−5.71	−7.87			−3.55
26250	−6.37	−8.75			−3.99
30000	−8.54	−11.53			−5.56
33750	−10.93	−14.45			−7.41
37500	−13.41	−17.41			−9.41
<b>Aberrations (peak to peak)</b>					
Filter or bandwidth	OC-768	none			5%
	FEC 43.02 Gb/s	none			5%
	40GBase-FR	none			5%
	100GBase-R4	none			5%
	100GBase-R4 FEC	none			5%
	30 GHz	none			5%
	65 GHz	none			10%
	80 GHz	none			12%

## 80C11 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test	Minimum	Incoming	Outgoing	Maximum
<b>Dark level (C1 at 100 <math>\mu</math>W)</b>				
OC-192/STM-64	-10 $\mu$ W			+10 $\mu$ W
10.66 Gb/s data filter	-10 $\mu$ W			+10 $\mu$ W
10.71 Gb/s data filter	-10 $\mu$ W			+10 $\mu$ W
10GBase-W	-10 $\mu$ W			+10 $\mu$ W
10GBase-R	-10 $\mu$ W			+10 $\mu$ W
10GBE FEC	-10 $\mu$ W			+10 $\mu$ W
10GFC	-10 $\mu$ W			+10 $\mu$ W
10GFC FEC	-10 $\mu$ W			+10 $\mu$ W
16GFC	-10 $\mu$ W			+10 $\mu$ W
20 GHz	-10 $\mu$ W			+10 $\mu$ W
30 GHz	-10 $\mu$ W			+10 $\mu$ W
<b>Vertical equivalent optical noise (C1 at 100 <math>\mu</math>W)</b>				
OC-192/STM-64	none			8.0 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			9.0 $\mu$ W <sub>RMS</sub>
10.66 Gb/s	none			8.0 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			9.0 $\mu$ W <sub>RMS</sub>
10.71 Gb/s	none			8.0 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			9.0 $\mu$ W <sub>RMS</sub>
10GBase-W	none			8.0 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			9.0 $\mu$ W <sub>RMS</sub>
10GBase-R	none			8.0 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			9.0 $\mu$ W <sub>RMS</sub>
10GBE FEC	none			8.0 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			9.0 $\mu$ W <sub>RMS</sub>
10GFC	none			8.0 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			9.0 $\mu$ W <sub>RMS</sub>
10GFC FEC	none			8.0 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			9.0 $\mu$ W <sub>RMS</sub>
16GFC	none			10.0 $\mu$ W <sub>RMS</sub>
Clock Recovery	none			11.5 $\mu$ W <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
	20 GHz	none			14.0 $\mu\text{W}_{\text{RMS}}$
	Clock Recovery	none			15.0 $\mu\text{W}_{\text{RMS}}$
	30 GHz	none			30.0 $\mu\text{W}_{\text{RMS}}$
	Clock Recovery	none			35.0 $\mu\text{W}_{\text{RMS}}$
<b>Minimum optical bandwidth</b>					
	20 GHz bandwidth setting	20 GHz			none
	30 GHz bandwidth setting	28 GHz			none
<b>10GBASE-W (9.95328 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	–0.85			+0.85
1500	–0.11	–0.96			+0.74
3000	–0.45	–1.30			+0.40
4500	–1.02	–1.87			+0.17
6000	–1.86	–2.71			–1.01
7500	–3.00	–3.86			–2.16
9000	–4.51	–6.19			–2.83
10000	–5.71	–7.87			–3.55
10500	–6.37	–8.75			–3.99
12000	–8.54	–11.53			–5.56
13500	–10.93	–14.45			–7.41
15000	–13.41	–17.41			–9.41
<b>10GBASE-R (10.3125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	–0.85			+0.85
1500	–0.11	–0.96			+0.74
3000	–0.45	–1.30			+0.40
4500	–1.02	–1.87			+0.17
6000	–1.86	–2.71			–1.01
7500	–3.00	–3.86			–2.16
9000	–4.51	–6.19			–2.83
10000	–5.71	–7.87			–3.55
10500	–6.37	–8.75			–3.99
12000	–8.54	–11.53			–5.56
13500	–10.93	–14.45			–7.41
15000	–13.41	–17.41			–9.41
<b>OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	–0.85			+0.85

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1493.2	-0.11	-0.96			+0.74
2986.0	-0.45	-1.30			+0.40
4478.8	-1.02	-1.87			+0.17
5972.4	-1.86	-2.71			-1.01
7465.0	-3.00	-3.86			-2.16
8958.0	-4.51	-6.19			-2.83
9953.28	-5.71	-7.87			-3.55
10451.2	-6.37	-8.75			-3.99
11944.0	-8.54	-11.53			-5.56
13437.2	-10.93	-14.45			-7.41
14930.4	-13.41	-17.41			-9.41

**10GFC (10.51875 Gb/s) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)	
0.00	0.00	-0.85
1500	-0.11	-0.96
3000	-0.45	-1.30
4500	-1.02	-1.87
6000	-1.86	-2.71
7500	-3.00	-3.86
9000	-4.51	-6.19
10000	-5.71	-7.87
10500	-6.37	-8.75
12000	-8.54	-11.53
13500	-10.93	-14.45
15000	-13.41	-17.41

**10GFC FEC (11.317 Gb/s) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)	
0.00	0.00	-0.85
1500	-0.11	-0.96
3000	-0.45	-1.30
4500	-1.02	-1.87
6000	-1.86	-2.71
7500	-3.00	-3.86
9000	-4.51	-6.19
10000	-5.71	-7.87
10500	-6.37	-8.75
12000	-8.54	-11.53
13500	-10.93	-14.45

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
15000	−13.41	−17.41			−9.41
<b>10GBE FEC (11.0957 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83
10000	−5.71	−7.87			−3.55
10500	−6.37	−8.75			−3.99
12000	−8.54	−11.53			−5.56
13500	−10.93	−14.45			−7.41
15000	−13.41	−17.41			−9.41
<b>10.66 Gb/s Reference Receiver frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1599.8	−0.11	−0.96			+0.74
3199.2	−0.45	−1.30			+0.40
4798.6	−1.02	−1.87			+0.17
6398.9	−1.86	−2.71			−1.01
7998.0	−3.00	−3.86			−2.16
9597.7	−4.51	−6.19			−2.83
10664.0	−5.71	−7.87			−3.55
11197.5	−6.37	−8.75			−3.99
12796.9	−8.54	−11.53			−5.56
14396.7	−10.93	−14.45			−7.41
15996.5	−13.41	−17.41			−9.41
<b>10.71 Gb/s Reference Receiver frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1606.6	−0.11	−0.96			+0.74
3212.8	−0.45	−1.30			+0.40
4819.0	−1.02	−1.87			+0.17
6426.0	−1.86	−2.71			−1.01
8032.0	−3.00	−3.86			−2.16
9638.4	−4.51	−6.19			−2.83



Instrument performance test		Minimum	Incoming	Outgoing	Maximum
10709.2	-5.71	-7.87			-3.55
11245.0	-6.37	-8.75			-3.99
12851.1	-8.54	-11.53			-5.56
14457.7	-10.93	-14.45			-7.41
16064.4	-13.41	-17.41			-9.41
<b>16GFC (14.025 Gb/s) Reference Receiver frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
2104	-0.11	-0.96			+0.74
4208	-0.45	-1.30			+0.40
6311	-1.02	-1.87			+0.17
8415	-1.86	-2.71			-1.01
10519	-3.00	-3.86			-2.16
12623	-4.51	-6.19			-2.83
14025	-5.71	-7.87			-3.55
14726	-6.37	-8.75			-3.99
16830	-8.54	-11.53			-5.56
18934	-10.93	-14.45			-7.41
21038	-13.41	-17.41			-9.41
<b>Recovered clock timing jitter (80C11-CR1 only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>
<b>Recovered clock timing jitter (80C11-CR2 only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>
10GBE FEC	20 ps	none			2 ps <sub>RMS</sub>
<b>Recovered clock timing jitter (80C11-CR3 only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>
G.709 FEC	20 ps	none			2 ps <sub>RMS</sub>
<b>Recovered clock timing jitter (80C11-CR4 only)</b>					
<i>Rate</i>	<i>Horiz scale</i>				
OC-192	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-W	20 ps	none			2 ps <sub>RMS</sub>
10GBASE-R	20 ps	none			2 ps <sub>RMS</sub>
10GFC	20 ps	none			2 ps <sub>RMS</sub>
10GBE	20 ps	none			2 ps <sub>RMS</sub>
G.975	20 ps	none			2 ps <sub>RMS</sub>

## Performance Tests

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Instrument performance test		Minimum	Incoming	Outgoing	Maximum
G.709	20 ps	none			2 ps <sub>RMS</sub>
Super FEC	20 ps	none			2 ps <sub>RMS</sub>

## 80C12 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level</b>					
<b>1550 nm (C1 at 1 <math>\mu</math>W)</b>	FC1063	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC2125	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC4250	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC8500	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBase-X4	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC-X4	-1.0 $\mu$ W			+1.0 $\mu$ W
	VSR-5 (3.318 Gb/s)	-1.0 $\mu$ W			+1.0 $\mu$ W
	9 GHz	-1.0 $\mu$ W			+1.0 $\mu$ W
<b>1310 nm (C1 at 1 <math>\mu</math>W)</b>	FC1063	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC2125	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC4250	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC8500	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBase-X4	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC-X4	-1.0 $\mu$ W			+1.0 $\mu$ W
	VSR-5 (3.318 Gb/s)	-1.0 $\mu$ W			+1.0 $\mu$ W
	9 GHz	-1.0 $\mu$ W			+1.0 $\mu$ W
<b>850 nm (C1 at 1 <math>\mu</math>W)</b>	FC1063	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC2125	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC4250	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC8500	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBase-X4	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC-X4	-1.0 $\mu$ W			+1.0 $\mu$ W
	VSR-5 (3.318 Gb/s)	-1.0 $\mu$ W			+1.0 $\mu$ W
	9 GHz	-1.0 $\mu$ W			+1.0 $\mu$ W
<b>Vertical equivalent optical noise</b>					

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1550 nm (C1 at 5 μW)	FC1063	none			2.5 μW <sub>RMS</sub>
	FC2125	none			2.5 μW <sub>RMS</sub>
	FC4250	none			2.5 μW <sub>RMS</sub>
	FC8500	none			2.5 μW <sub>RMS</sub>
	10GBase-X4	none			2.5 μW <sub>RMS</sub>
	10GFC-X4	none			2.5 μW <sub>RMS</sub>
	VSR-5 (3.318 Gb/s)	none			2.5 μW <sub>RMS</sub>
	9 GHz	none			5 μW <sub>RMS</sub>
1310 nm (C1 at 5 μW)	FC1063	none			2.5 μW <sub>RMS</sub>
	FC2125	none			2.5 μW <sub>RMS</sub>
	FC4250	none			2.5 μW <sub>RMS</sub>
	FC8500	none			2.5 μW <sub>RMS</sub>
	10GBase-X4	none			2.5 μW <sub>RMS</sub>
	10GFC-X4	none			2.5 μW <sub>RMS</sub>
	VSR-5 (3.318 Gb/s)	none			2.5 μW <sub>RMS</sub>
	9 GHz	none			5.0 μW <sub>RMS</sub>
850 nm (C1 at 5 μW)	FC1063	none			4.0 μW <sub>RMS</sub>
	FC2125	none			4.0 μW <sub>RMS</sub>
	FC4250	none			4.0 μW <sub>RMS</sub>
	FC8500	none			4.0 μW <sub>RMS</sub>
	10GBase-X4	none			4.0 μW <sub>RMS</sub>
	10GFC-X4	none			4.0 μW <sub>RMS</sub>
	VSR-5 (3.318 Gb/s)	none			4.0 μW <sub>RMS</sub>
	9 GHz	none			8.0 μW <sub>RMS</sub>
Minimum optical bandwidth (Options F2, F3, F5, F6, FC)					
9 GHz bandwidth setting		8.5 GHz			none
FC1063 (1.0625 Gb/s) Reference Receiver setting frequency response (dB)					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	−0.50			+0.50
159.5	−0.11	−0.61			+0.39
318.9	−0.45	−0.95			+0.05
478.4	−1.02	−1.52			−0.52
637.9	−1.86	−2.36			−1.36
797.4	−3.00	−3.50			−2.50
956.8	−4.51	−5.67			−3.35
1063	−5.71	−7.25			−4.17
1116	−6.37	−8.08			−4.66
1275	−8.54	−10.74			−6.35

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1435	-10.93	-13.55			-8.31
1595	-13.41	-16.41			-10.41
<b>FC2125 (2.125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
318.8	-0.11	-0.61			+0.39
637.5	-0.45	-0.95			+0.05
956.3	-1.02	-1.52			-0.52
1275	-1.86	-2.36			-1.36
1594	-3.00	-3.50			-2.50
1913	-4.51	-5.67			-3.35
2125	-5.71	-7.25			-4.17
2231	-6.37	-8.08			-4.66
2550	-8.54	-10.74			-6.35
2869	-10.93	-13.55			-8.31
3188	-13.41	-16.41			-10.41
<b>10GBASE-X4 (3.125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
468.8	-0.11	-0.61			+0.39
937.5	-0.45	-0.95			+0.05
1406	-1.02	-1.52			-0.52
1875	-1.86	-2.36			-1.36
2344	-3.00	-3.50			-2.50
2813	-4.51	-5.67			-3.35
3125	-5.71	-7.25			-4.17
3281	-6.37	-8.08			-4.66
3750	-8.54	-10.74			-6.35
4219	-10.93	-13.55			-8.31
4688	-13.41	-16.41			-10.41
<b>10GFC-X4 (3.188 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
478.1	-0.11	-0.61			+0.39
956.3	-0.45	-0.95			+0.05
1434	-1.02	-1.52			-0.52
1913	-1.86	-2.36			-1.36
2391	-3.00	-3.50			-2.50

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
2869	-4.51	-5.67			-3.35
3188	-5.71	-7.25			-4.17
3347	-6.37	-8.08			-4.66
3825	-8.54	-10.74			-6.35
4303	-10.93	-13.55			-8.31
4781	-13.41	-16.41			-10.41
<b>FC4250 (4.250 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
637.5	-0.11	-0.61			+0.39
1275	-0.45	-0.95			+0.05
1913	-1.02	-1.52			-0.52
2550	-1.86	-2.36			-1.36
3188	-3.00	-3.50			-2.50
3826	-4.51	-5.67			-3.35
4250	-5.71	-7.25			-4.17
4462	-6.37	-8.08			-4.66
5100	-8.54	-10.74			-6.35
5738	-10.93	-13.55			-8.31
6375	-13.41	-16.41			-10.41
<b>VSR-5 (3.318 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
497.7	-0.11	-0.61			+0.39
995.3	-0.45	-0.95			+0.05
1493	-1.02	-1.52			-0.52
1991	-1.86	-2.36			-1.36
2488	-3.00	-3.50			-2.50
2986	-4.51	-5.67			-3.35
3318	-5.71	-7.25			-4.17
3484	-6.37	-8.08			-4.66
3981	-8.54	-10.74			-6.35
4479	-10.93	-13.55			-8.31
4977	-13.41	-16.41			-10.41

## 80C12-10G Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level</b>					
<b>1550 nm (C1 at 1 <math>\mu</math>W)</b>	OC-192/STM-64	–1.0 $\mu$ W			+1.0 $\mu$ W
	10.66 data filter	–1.0 $\mu$ W			+1.0 $\mu$ W
	10.71 data filter	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBase-W	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBase-R	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBE FEC	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC FEC	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC8500	–1.0 $\mu$ W			+1.0 $\mu$ W
<b>1310 nm (C1 at 1 <math>\mu</math>W)</b>	OC-192/STM-64	–1.0 $\mu$ W			+1.0 $\mu$ W
	10.66 data filter	–1.0 $\mu$ W			+1.0 $\mu$ W
	10.71 data filter	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBase-W	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBase-R	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBE FEC	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC FEC	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC8500	–1.0 $\mu$ W			+1.0 $\mu$ W
<b>850 nm (C1 at 1 <math>\mu</math>W)</b>	OC-192/STM-64	–1.0 $\mu$ W			+1.0 $\mu$ W
	10.66 data filter	–1.0 $\mu$ W			+1.0 $\mu$ W
	10.71 data filter	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBase-W	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBase-R	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBE FEC	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC FEC	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC8500	–1.0 $\mu$ W			+1.0 $\mu$ W
<b>Vertical equivalent optical noise</b>					

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1550 nm (C1 at 5 $\mu$ W)	OC-192/STM-64	none			5.0 $\mu$ W <sub>RMS</sub>
	10.66 data filter	none			5.0 $\mu$ W <sub>RMS</sub>
	10.71 data filter	none			5.0 $\mu$ W <sub>RMS</sub>
	10GBase-W	none			5.0 $\mu$ W <sub>RMS</sub>
	10GBase-R	none			5.0 $\mu$ W <sub>RMS</sub>
	10GBE FEC	none			5.0 $\mu$ W <sub>RMS</sub>
	10GFC	none			5.0 $\mu$ W <sub>RMS</sub>
	10GFC FEC	none			5.0 $\mu$ W <sub>RMS</sub>
	FC8500	none			5.0 $\mu$ W <sub>RMS</sub>
1310 nm (C1 at 5 $\mu$ W)	OC-192/STM-64	none			5.0 $\mu$ W <sub>RMS</sub>
	10.66 data filter	none			5.0 $\mu$ W <sub>RMS</sub>
	10.71 data filter	none			5.0 $\mu$ W <sub>RMS</sub>
	10GBase-W	none			5.0 $\mu$ W <sub>RMS</sub>
	10GBase-R	none			5.0 $\mu$ W <sub>RMS</sub>
	10GBE FEC	none			5.0 $\mu$ W <sub>RMS</sub>
	10GFC	none			5.0 $\mu$ W <sub>RMS</sub>
	10GFC FEC	none			5.0 $\mu$ W <sub>RMS</sub>
	FC8500	none			5.0 $\mu$ W <sub>RMS</sub>
850 nm (C1 at 5 $\mu$ W)	OC-192/STM-64	none			8.0 $\mu$ W <sub>RMS</sub>
	10.66 data filter	none			8.0 $\mu$ W <sub>RMS</sub>
	10.71 data filter	none			8.0 $\mu$ W <sub>RMS</sub>
	10GBase-W	none			8.0 $\mu$ W <sub>RMS</sub>
	10GBase-R	none			8.0 $\mu$ W <sub>RMS</sub>
	10GBE FEC	none			8.0 $\mu$ W <sub>RMS</sub>
	10GFC	none			8.0 $\mu$ W <sub>RMS</sub>
	10GFC FEC	none			8.0 $\mu$ W <sub>RMS</sub>
	FC8500	none			8.0 $\mu$ W <sub>RMS</sub>
<b>Minimum optical bandwidth</b>					
10 GHz bandwidth setting		9.5 GHz			none
<b>10GBASE-W (9.95328 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83



Instrument performance test		Minimum	Incoming	Outgoing	Maximum
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10GBASE-R (10.3125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1493.2	-0.11	-0.96			+0.74
2986.0	-0.45	-1.30			+0.40
4478.8	-1.02	-1.87			+0.17
5972.4	-1.86	-2.71			-1.01
7465.0	-3.00	-3.86			-2.16
8958.0	-4.51	-6.19			-2.83
9953.28	-5.71	-7.87			-3.55
10451.2	-6.37	-8.75			-3.99
11944.0	-8.54	-11.53			-5.56
13437.2	-10.93	-14.45			-7.41
14930.4	-13.41	-17.41			-9.41
<b>10GFC (10.51875 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10GFC FEC (11.317 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10GBE FEC (11.0957 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10.66 Gb/s Data Filter setting frequency response (dB)</b>					

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10.71 Gb/s Reference Receiver frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1606.6	-0.11	-0.96			+0.74
3212.8	-0.45	-1.30			+0.40
4819.0	-1.02	-1.87			+0.17
6426.0	-1.86	-2.71			-1.01
8032.0	-3.00	-3.86			-2.16
9638.4	-4.51	-6.19			-2.83
10709.2	-5.71	-7.87			-3.55
11245.0	-6.37	-8.75			-3.99
12851.1	-8.54	-11.53			-5.56
14457.7	-10.93	-14.45			-7.41
16064.4	-13.41	-17.41			-9.41

## 80C12B Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level</b>					
<b>1550 nm (C1 at 3 <math>\mu</math>W/div)</b>	12 GHz (Opt F0)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-3/STM-1 (Opt F1)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-12/STM-4 (Opt F2)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC1063 (Opt F3)	–1.0 $\mu$ W			+1.0 $\mu$ W
	Gigabit Ethernet (ENET1250) (Opt F4)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC2125 (Opt F5)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-48/STM-16 (Opt F6)	–1.0 $\mu$ W			+1.0 $\mu$ W
	2GBE (Opt F6)	–1.0 $\mu$ W			+1.0 $\mu$ W
	INF2500 (Opt F6)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC2.666 Gb/s (FEC2666) (Opt F7)	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-X4 (Opt F8)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC-3188 (Opt F8)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC4250 (Opt F9)	–1.0 $\mu$ W			+1.0 $\mu$ W
	INF5000 (Opt F10)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OBSAI 6.144 Gb/s (Opt F11)	–1.0 $\mu$ W			+1.0 $\mu$ W
	CPRI 7.373 Gb/s (Opt F12)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC8500 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	8GFC (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-192/STM-64 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-W (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1310 nm (C1 at 3 $\mu$ W/div)	10GBASE-R (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	40GBASE-R4 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	100GBASE-R10 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.66 Gb/s (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.71 Gb/s (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC11.10 Gb/s (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC11317 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	12 GHz (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	12 GHz (Opt F0)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-3/STM-1 (Opt F1)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-12/STM-4 (Opt F2)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC1063 (Opt F3)	–1.0 $\mu$ W			+1.0 $\mu$ W
	Gigabit Ethernet (ENET1250) (Opt F4)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC2125 (Opt F5)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-48/STM-16 (Opt F6)	–1.0 $\mu$ W			+1.0 $\mu$ W
	2GBE (Opt F6)	–1.0 $\mu$ W			+1.0 $\mu$ W
	INF2500 (Opt F6)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC2.666 Gb/s (FEC2666) (Opt F7)	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-X4 (Opt F8)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC-3188 (Opt F8)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC4250 (Opt F9)	–1.0 $\mu$ W			+1.0 $\mu$ W
	INF5000 (Opt F10)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OBSAI 6.144 Gb/s (Opt F11)	–1.0 $\mu$ W			+1.0 $\mu$ W
	CPRI 7.373 Gb/s (Opt F12)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC8500 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	8GFC (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-192/STM-64 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-W (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W

Instrument performance test	Minimum	Incoming	Outgoing	Maximum
10GBASE-R (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
40GBASE-R4 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
100GBASE-R10 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
10GFC (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
FEC10.66 Gb/s (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
FEC10.71 Gb/s (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
FEC11.10 Gb/s (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
FEC11317 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
12 GHz (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
850 nm (C1 at 3 $\mu$ W/div)	12 GHz (Opt F0)	–1.0 $\mu$ W		+1.0 $\mu$ W
	OC-3/STM-1 (Opt F1)	–1.0 $\mu$ W		+1.0 $\mu$ W
	OC-12/STM-4 (Opt F2)	–1.0 $\mu$ W		+1.0 $\mu$ W
	FC1063 (Opt F3)	–1.0 $\mu$ W		+1.0 $\mu$ W
	Gigabit Ethernet (ENET1250) (Opt F4)	–1.0 $\mu$ W		+1.0 $\mu$ W
	FC2125 (Opt F5)	–1.0 $\mu$ W		+1.0 $\mu$ W
	OC-48/STM-16 (Opt F6)	–1.0 $\mu$ W		+1.0 $\mu$ W
	2GBE (Opt F6)	–1.0 $\mu$ W		+1.0 $\mu$ W
	INF2500 (Opt F6)	–1.0 $\mu$ W		+1.0 $\mu$ W
	FEC2.666 Gb/s (FEC2666) (Opt F7)	–1.0 $\mu$ W		+1.0 $\mu$ W
	10GBASE-X4 (Opt F8)	–1.0 $\mu$ W		+1.0 $\mu$ W
	FC-3188 (Opt F8)	–1.0 $\mu$ W		+1.0 $\mu$ W
	FC4250 (Opt F9)	–1.0 $\mu$ W		+1.0 $\mu$ W
	INF5000 (Opt F10)	–1.0 $\mu$ W		+1.0 $\mu$ W
	OBSAI 6.144 Gb/s (Opt F11)	–1.0 $\mu$ W		+1.0 $\mu$ W
	CPRI 7.373 Gb/s (Opt F12)	–1.0 $\mu$ W		+1.0 $\mu$ W
	FC8500 (Opt 10GP)	–1.0 $\mu$ W		+1.0 $\mu$ W
	8GFC (Opt 10GP)	–1.0 $\mu$ W		+1.0 $\mu$ W
	OC-192/STM-64 (Opt 10GP)	–1.0 $\mu$ W		+1.0 $\mu$ W
	10GBASE-W (Opt 10GP)	–1.0 $\mu$ W		+1.0 $\mu$ W

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
	10GBASE-R (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	40GBASE-R4 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	100GBASE-R10 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.66 Gb/s (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.71 Gb/s (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC11.10 Gb/s (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC11317 (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
	12 GHz (Opt 10GP)	–1.0 $\mu$ W			+1.0 $\mu$ W
<b>Vertical equivalent optical noise</b>					
<b>1550 nm (C1 at 3 <math>\mu</math>W)</b>	12 GHz (Opt F0)	none			3.0 $\mu$ W <sub>RMS</sub>
	OC-3/STM-1 (Opt F1)	none			1.3 $\mu$ W <sub>RMS</sub>
	OC-12/STM-4 (Opt F2)	none			1.3 $\mu$ W <sub>RMS</sub>
	FC1063 (Opt F3)	none			1.3 $\mu$ W <sub>RMS</sub>
	Gigabit Ethernet (ENET1250) (Opt F4)	none			1.3 $\mu$ W <sub>RMS</sub>
	FC2125 (Opt F5)	none			1.5 $\mu$ W <sub>RMS</sub>
	OC-48/STM-16 (Opt F6)	none			1.5 $\mu$ W <sub>RMS</sub>
	2GBE (Opt F6)	none			1.5 $\mu$ W <sub>RMS</sub>
	INF2500 (Opt F6)	none			1.5 $\mu$ W <sub>RMS</sub>
	FEC2.666 Gb/s (FEC2666) (Opt F7)	none			1.5 $\mu$ W <sub>RMS</sub>
	10GBASE-X4 (Opt F8)	none			1.5 $\mu$ W <sub>RMS</sub>
	FC-3188 (Opt F8)	none			1.5 $\mu$ W <sub>RMS</sub>
	FC4250 (Opt F9)	none			1.5 $\mu$ W <sub>RMS</sub>
	INF5000 (Opt F10)	none			2.2 $\mu$ W <sub>RMS</sub>
	OBSAI 6.144 Gb/s (Opt F11)	none			2.2 $\mu$ W <sub>RMS</sub>
	CPRI 7.373 Gb/s (Opt F12)	none			2.2 $\mu$ W <sub>RMS</sub>
	FC8500 (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	8GFC (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64 (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	10GBASE-W (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1310 nm (C1 at 3 $\mu$ W/div)	10GBASE-R (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	40GBASE-R4 (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	100GBASE-R10 (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	10GFC (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	FEC10.66 Gb/s (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	FEC10.71 Gb/s (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	FEC11.10 Gb/s (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	FEC11317 (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	12 GHz (Opt 10GP)	none			3.6 $\mu$ W <sub>RMS</sub>
	12 GHz (Opt F0)	none			2.8 $\mu$ W <sub>RMS</sub>
	OC-3/STM-1 (Opt F1)	none			1.3 $\mu$ W <sub>RMS</sub>
	OC-12/STM-4 (Opt F2)	none			1.3 $\mu$ W <sub>RMS</sub>
	FC1063 (Opt F3)	none			1.3 $\mu$ W <sub>RMS</sub>
	Gigabit Ethernet (ENET1250) (Opt F4)	none			1.3 $\mu$ W <sub>RMS</sub>
	FC2125 (Opt F5)	none			1.5 $\mu$ W <sub>RMS</sub>
	OC-48/STM-16 (Opt F6)	none			1.5 $\mu$ W <sub>RMS</sub>
	2GBE (Opt F6)	none			1.5 $\mu$ W <sub>RMS</sub>
	INF2500 (Opt F6)	none			1.5 $\mu$ W <sub>RMS</sub>
	FEC2.666 Gb/s (FEC2666) (Opt F7)	none			1.5 $\mu$ W <sub>RMS</sub>
	10GBASE-X4 (Opt F8)	none			1.5 $\mu$ W <sub>RMS</sub>
	FC-3188 (Opt F8)	none			1.5 $\mu$ W <sub>RMS</sub>
	FC4250 (Opt F9)	none			1.5 $\mu$ W <sub>RMS</sub>
	INF5000 (Opt F10)	none			2.2 $\mu$ W <sub>RMS</sub>
	OBSAI 6.144 Gb/s (Opt F11)	none			2.2 $\mu$ W <sub>RMS</sub>
	CPRI 7.373 Gb/s (Opt F12)	none			2.2 $\mu$ W <sub>RMS</sub>
	FC8500 (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	8GFC (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64 (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>
	10GBASE-W (Opt 10GP)	none			2.7 $\mu$ W <sub>RMS</sub>



Instrument performance test		Minimum	Incoming	Outgoing	Maximum
	10GBASE-R (Opt 10GP)	none			2.7 $\mu W_{RMS}$
	40GBASE-R4 (Opt 10GP)	none			2.7 $\mu W_{RMS}$
	100GBASE-R10 (Opt 10GP)	none			2.7 $\mu W_{RMS}$
	10GFC (Opt 10GP)	none			2.7 $\mu W_{RMS}$
	FEC10.66 Gb/s (Opt 10GP)	none			2.7 $\mu W_{RMS}$
	FEC10.71 Gb/s (Opt 10GP)	none			2.7 $\mu W_{RMS}$
	FEC11.10 Gb/s (Opt 10GP)	none			2.7 $\mu W_{RMS}$
	FEC11317 (Opt 10GP)	none			2.7 $\mu W_{RMS}$
	12 GHz (Opt 10GP)	none			3.6 $\mu W_{RMS}$
	12 GHz (Opt F0)	none			5.5 $\mu W_{RMS}$
	OC-3/STM-1 (Opt F1)	none			2.1 $\mu W_{RMS}$
	OC-12/STM-4 (Opt F2)	none			2.1 $\mu W_{RMS}$
	FC1063 (Opt F3)	none			2.1 $\mu W_{RMS}$
	Gigabit Ethernet (ENET1250) (Opt F4)	none			2.1 $\mu W_{RMS}$
	FC2125 (Opt F5)	none			2.4 $\mu W_{RMS}$
	OC-48/STM-16 (Opt F6)	none			2.4 $\mu W_{RMS}$
	2GBE (Opt F6)	none			2.4 $\mu W_{RMS}$
	INF2500 (Opt F6)	none			2.4 $\mu W_{RMS}$
	FEC2.666 Gb/s (FEC2666) (Opt F7)	none			2.4 $\mu W_{RMS}$
850 nm (C1 at 3 $\mu W$ )	10GBASE-X4 (Opt F8)	none			2.4 $\mu W_{RMS}$
	FC-3188 (Opt F8)	none			2.4 $\mu W_{RMS}$
	FC4250 (Opt F9)	none			2.4 $\mu W_{RMS}$
	INF5000 (Opt F10)	none			3.5 $\mu W_{RMS}$
	OBSAI 6.144 Gb/s (Opt F11)	none			3.5 $\mu W_{RMS}$
	CPRI 7.373 Gb/s (Opt F12)	none			3.5 $\mu W_{RMS}$
	FC8500 (Opt 10GP)	none			4.3 $\mu W_{RMS}$
	8GFC (Opt 10GP)	none			4.3 $\mu W_{RMS}$
	OC-192/STM-64 (Opt 10GP)	none			4.3 $\mu W_{RMS}$
	10GBASE-W (Opt 10GP)	none			4.3 $\mu W_{RMS}$

Instrument performance test	Minimum	Incoming	Outgoing	Maximum
10GBASE-R (Opt 10GP)	none			4.3 $\mu\text{W}_{\text{RMS}}$
40GBASE-R4 (Opt 10GP)	none			4.3 $\mu\text{W}_{\text{RMS}}$
100GBASE-R10 (Opt 10GP)	none			4.3 $\mu\text{W}_{\text{RMS}}$
10GFC (Opt 10GP)	none			4.3 $\mu\text{W}_{\text{RMS}}$
FEC10.66 Gb/s (Opt 10GP)	none			4.3 $\mu\text{W}_{\text{RMS}}$
FEC10.71 Gb/s (Opt 10GP)	none			4.3 $\mu\text{W}_{\text{RMS}}$
FEC11.10 Gb/s (Opt 10GP)	none			4.3 $\mu\text{W}_{\text{RMS}}$
FEC11317 (Opt 10GP)	none			4.3 $\mu\text{W}_{\text{RMS}}$
12 GHz (Opt 10GP)	none			35.5 $\mu\text{W}_{\text{RMS}}$

**Minimum optical bandwidth (Options F0, 10GP)**

12 GHz bandwidth setting	11 GHz			none
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Instrument performance test	Minimum	Incoming	Outgoing	Maximum
<b>OC-3/STM-1 (155 Mb/s) Reference Receiver setting frequency response (dB) (Opt F1)</b>				
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>			
0.00	0.00	−0.50		+0.50
23.3	−0.11	−0.61		+0.39
46.65	−0.45	−0.95		+0.05
69.98	−1.02	−1.52		−0.52
93.3	−1.86	−2.36		−1.36
116.7	−3.00	−3.50		−2.50
140.0	−4.51	−5.67		−3.35
155.5	−5.71	−7.25		−4.17
163.3	−6.37	−8.08		−4.66
186.6	−8.54	−10.74		−6.35
209.9	−10.93	−13.55		−8.31
233.3	−13.41	−16.41		−10.41

**OC-12/STM-4 (622 Mb/s) Reference Receiver setting frequency response (dB) (Opt F2)**

<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>			
0.00	0.00	−0.50		+0.50
93.3	−0.11	−0.61		+0.39
186.6	−0.45	−0.95		+0.05
279.9	−1.02	−1.52		−0.52
373.2	−1.86	−2.36		−1.36
466.7	−3.00	−3.50		−2.50

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
559.9	-4.51	-5.67			-3.35
622.1	-5.71	-7.25			-4.17
653.2	-6.37	-8.08			-4.66
746.5	-8.54	-10.74			-6.35
839.8	-10.93	-13.55			-8.31
933.1	-13.41	-16.41			-10.41
<b>FC1063 (1.0625 Gb/s) Reference Receiver setting frequency response (dB) (Opt F3)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
159.5	-0.11	-0.61			+0.39
318.9	-0.45	-0.95			+0.05
478.4	-1.02	-1.52			-0.52
637.9	-1.86	-2.36			-1.36
797.4	-3.00	-3.50			-2.50
956.8	-4.51	-5.67			-3.35
1063	-5.71	-7.25			-4.17
1116	-6.37	-8.08			-4.66
1275	-8.54	-10.74			-6.35
1435	-10.93	-13.55			-8.31
1595	-13.41	-16.41			-10.41
<b>ENET1250 (GBE) 1.25 Gb/s Reference Receiver setting frequency response (dB) (Opt F4)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
187.5	-0.11	-0.61			+0.39
375	-0.45	-0.95			+0.05
562.5	-1.02	-1.52			-0.52
750	-1.86	-2.36			-1.36
937.5	-3.00	-3.50			-2.50
1125	-4.51	-5.67			-3.35
1250	-5.71	-7.25			-4.17
1312.5	-6.37	-8.08			-4.66
1500	-8.54	-10.74			-6.35
1687.5	-10.93	-13.55			-8.31
1875	-13.41	-16.41			-10.41
<b>FC2125 (2.125 Gb/s) Reference Receiver setting frequency response (dB) (Opt F5)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
318.8	-0.11	-0.61			+0.39

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
637.5	−0.45	−0.95			+0.05
956.3	−1.02	−1.52			−0.52
1275	−1.86	−2.36			−1.36
1594	−3.00	−3.50			−2.50
1913	−4.51	−5.67			−3.35
2125	−5.71	−7.25			−4.17
2231	−6.37	−8.08			−4.66
2550	−8.54	−10.74			−6.35
2869	−10.93	−13.55			−8.31
3188	−13.41	−16.41			−10.41
<b>OC-48/STM-16 2.488 Gb/s Reference Receiver setting frequency response (dB) (Opt F6)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.50			+0.50
373.3	−0.11	−0.61			+0.39
746.5	−0.45	−0.95			+0.05
1119.7	−1.02	−1.52			−0.52
1493.1	−1.86	−2.36			−1.36
1866.3	−3.00	−3.50			−2.50
2239.5	−4.51	−5.67			−3.35
2488.3	−5.71	−7.25			−4.17
2612.8	−6.37	−8.08			−4.66
2986.0	−8.54	−10.74			−6.35
3359.3	−10.93	−13.55			−8.31
3732.6	−13.41	−16.41			−10.41
<b>ENET2500 (2 GBE) (2.50 Gb/s) Reference Receiver setting frequency response (dB) (Opt F6)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.50			+0.50
375	−0.11	−0.61			+0.39
750	−0.45	−0.95			+0.05
1125	−1.02	−1.52			−0.52
1500	−1.86	−2.36			−1.36
1875	−3.00	−3.50			−2.50
2250	−4.51	−5.67			−3.35
2500	−5.71	−7.25			−4.17
2625	−6.37	−8.08			−4.66
3000	−8.54	−10.74			−6.35
3375	−10.93	−13.55			−8.31
3750	−13.41	−16.41			−10.41

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>INF2500 (2.50 Gb/s) Reference Receiver setting frequency response (dB) (Opt F6)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
375	-0.11	-0.61			+0.39
750	-0.45	-0.95			+0.05
1125	-1.02	-1.52			-0.52
1500	-1.86	-2.36			-1.36
1875	-3.00	-3.50			-2.50
2250	-4.51	-5.67			-3.35
2500	-5.71	-7.25			-4.17
2625	-6.37	-8.08			-4.66
3000	-8.54	-10.74			-6.35
3375	-10.93	-13.55			-8.31
3750	-13.41	-16.41			-10.41
<b>FEC2.666 Gb/s (OC48) Reference Receiver setting frequency response (dB) (Opt F7)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
400	-0.11	-0.61			+0.39
799.8	-0.45	-0.95			+0.05
1282.5	-1.02	-1.52			-0.52
1599.8	-1.86	-2.36			-1.36
1999.6	-3.00	-3.50			-2.50
2399.5	-4.51	-5.67			-3.35
2666.0	-5.71	-7.25			-4.17
2799.4	-6.37	-8.08			-4.66
3199.3	-8.54	-10.74			-6.35
3528.7	-10.93	-13.55			-8.31
3999.2	-13.41	-16.41			-10.41
<b>10GBASE-X4 ENET3125 (3.125 Gb/s) Reference Receiver setting frequency response (dB) (Opt F8)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
468.8	-0.11	-0.61			+0.39
937.5	-0.45	-0.95			+0.05
1406	-1.02	-1.52			-0.52
1875	-1.86	-2.36			-1.36
2344	-3.00	-3.50			-2.50
2813	-4.51	-5.67			-3.35
3125	-5.71	-7.25			-4.17

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
3281	-6.37	-8.08			-4.66
3750	-8.54	-10.74			-6.35
4219	-10.93	-13.55			-8.31
4688	-13.41	-16.41			-10.41
<b>10GFC-X4 FC-3188 (3.188 Gb/s) Reference Receiver setting frequency response (dB) (Opt F8)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
478.1	-0.11	-0.61			+0.39
956.3	-0.45	-0.95			+0.05
1434	-1.02	-1.52			-0.52
1913	-1.86	-2.36			-1.36
2391	-3.00	-3.50			-2.50
2869	-4.51	-5.67			-3.35
3188	-5.71	-7.25			-4.17
3347	-6.37	-8.08			-4.65
3825	-8.54	-10.74			-6.35
4303	-10.93	-13.55			-8.31
4781	-13.41	-16.41			-10.41
<b>FC4250 (4.250 Gb/s) Reference Receiver setting frequency response (dB) (Opt F9)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.50			+0.50
637.5	-0.11	-0.61			+0.39
1275	-0.45	-0.95			+0.05
1913	-1.02	-1.52			-0.52
2550	-1.86	-2.36			-1.36
3188	-3.00	-3.50			-2.50
3826	-4.51	-5.67			-3.35
4250	-5.71	-7.25			-4.17
4462	-6.37	-8.08			-4.66
5100	-8.54	-10.74			-6.35
5738	-10.93	-13.55			-8.31
6375	-13.41	-16.41			-10.41
<b>INF5000 (5.0 Gb/s) Reference Receiver setting frequency response (dB) (Opt F10)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.75			+0.75
750	-0.11	-0.86			+0.64
1500	-0.45	-1.20			+0.30
2250	-1.02	-1.77			-0.27

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
3000	-1.86	-2.61			-1.11
3750	-3.00	-3.75			-2.25
4500	-4.51	-5.98			-3.04
5000	-5.71	-7.60			-3.82
5250	-6.37	-8.45			-4.28
6000	-8.54	-11.16			-5.93
6750	-10.93	-14.01			-7.84
7500	-13.41	-16.91			-9.91

**OBSAI (6.144 GB/s) Reference Receiver setting frequency response (dB) (Opt F11)**

Frequency (MHz)	Nominal response (dB)	
0.00	0.00	-0.85
922	-0.11	-0.96
1843	-0.45	-1.30
2765	-1.02	-1.87
3686	-1.86	-2.71
4608	-3.00	-3.86
5530	-4.51	-6.19
6144	-5.71	-7.87
6451	-6.37	-8.75
7373	-8.54	-11.53
8234	-10.93	-14.45
9216	-13.41	-17.41

**CPRI (7.373 GB/s) Reference Receiver setting frequency response (dB) (Opt F12)**

0.00	0.00	-0.85
1106	-0.11	-0.96
2212	-0.45	-1.30
3318	-1.02	-1.87
4423	-1.86	-2.71
5767	-3.00	-3.86
6636	-4.51	-6.19
7373	-5.71	-7.87
7741	-6.37	-8.75
8848	-8.54	-11.53
9881	-10.93	-14.45
11059	-13.41	-17.41

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
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**FC8500 (8.5 Gb/s) Reference Receiver setting frequency response (dB) (Opt 10GP)**

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1275	-0.11	-0.96			+0.74
2550	-0.45	-1.30			+0.40
3825	-1.02	-1.87			+0.17
5100	-1.86	-2.71			-1.01
6375	-3.00	-3.86			-2.16
7650	-4.51	-6.19			-2.83
8500	-5.71	-7.87			-3.55
8925	-6.37	-8.75			-3.99
10200	-8.54	-11.53			-5.56
11475	-10.93	-14.45			-7.41
12750	-13.41	-17.41			-9.41
<b>8GFC (FC8500FINAL) (8.5 Gb/s) Reference Receiver setting frequency response (dB) (Opt 10GP)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB) (Opt 10GP)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1493.2	-0.11	-0.96			+0.74
2986.0	-0.45	-1.30			+0.40
4478.8	-1.02	-1.87			+0.17
5972.4	-1.86	-2.71			-1.01
7465.0	-3.00	-3.86			-2.16
8958.0	-4.51	-6.19			-2.83
9953.28	-5.71	-7.87			-3.55
10451.2	-6.37	-8.75			-3.99



Instrument performance test		Minimum	Incoming	Outgoing	Maximum
11944.0	-8.54	-11.53			-5.56
13437.2	-10.93	-14.45			-7.41
14930.4	-13.41	-17.41			-9.41
<b>10GBASE-W (9.95328 Gb/s) Reference Receiver setting frequency response (dB) (Opt 10GP)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10GBASE-R (10.3125 Gb/s) Reference Receiver setting frequency response (dB) (Opt 10GP)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>40GBASE-R4 (10.3125 Gb/s) Reference Receiver setting frequency response (dB) (Opt 10GP)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41

**100GBASE-R10 (10.3125 Gb/s) Reference Receiver setting frequency response (dB) (Opt 10GP)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	-0.85		+0.85
1500	-0.11	-0.96		+0.74
3000	-0.45	-1.30		+0.40
4500	-1.02	-1.87		+0.17
6000	-1.86	-2.71		-1.01
7500	-3.00	-3.86		-2.16
9000	-4.51	-6.19		-2.83
10000	-5.71	-7.87		-3.55
10500	-6.37	-8.75		-3.99
12000	-8.54	-11.53		-5.56
13500	-10.93	-14.45		-7.41
15000	-13.41	-17.41		-9.41

**10GFC (10.51875 Gb/s) Reference Receiver setting frequency response (dB) (Opt 10GP)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	-0.85		+0.85
1500	-0.11	-0.96		+0.74
3000	-0.45	-1.30		+0.40
4500	-1.02	-1.87		+0.17
6000	-1.86	-2.71		-1.01
7500	-3.00	-3.86		-2.16
9000	-4.51	-6.19		-2.83
10000	-5.71	-7.87		-3.55
10500	-6.37	-8.75		-3.99
12000	-8.54	-11.53		-5.56
13500	-10.93	-14.45		-7.41
15000	-13.41	-17.41		-9.41

**FEC10.66 Gb/s Reference Receiver frequency response (dB) (Opt 10GP)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	-0.85		+0.85

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1599.8	-0.11	-0.96			+0.74
3199.2	-0.45	-1.30			+0.40
4798.6	-1.02	-1.87			+0.17
6398.9	-1.86	-2.71			-1.01
7998.0	-3.00	-3.86			-2.16
9597.7	-4.51	-6.19			-2.83
10664.0	-5.71	-7.87			-3.55
11197.5	-6.37	-8.75			-3.99
12796.9	-8.54	-11.53			-5.56
14396.7	-10.93	-14.45			-7.41
15996.5	-13.41	-17.41			-9.41

#### **FEC10.71 Gb/s (G.709) Reference Receiver frequency response (dB) (Opt 10GP)**

<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>		
0.00	0.00	-0.85	+0.85
1606.6	-0.11	-0.96	+0.74
3212.8	-0.45	-1.30	+0.40
4819.0	-1.02	-1.87	+0.17
6426.0	-1.86	-2.71	-1.01
8032.0	-3.00	-3.86	-2.16
9638.4	-4.51	-6.19	-2.83
10709.2	-5.71	-7.87	-3.55
11245.0	-6.37	-8.75	-3.99
12851.1	-8.54	-11.53	-5.56
14457.7	-10.93	-14.45	-7.41
16064.4	-13.41	-17.41	-9.41

#### **FEC11.10 Gb/s (ENET11096) Reference Receiver setting frequency response (dB) (Opt 10GP)**

<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>		
0.00	0.00	-0.85	+0.85
1500	-0.11	-0.96	+0.74
3000	-0.45	-1.30	+0.40
4500	-1.02	-1.87	+0.17
6000	-1.86	-2.71	-1.01
7500	-3.00	-3.86	-2.16
9000	-4.51	-6.19	-2.83
10000	-5.71	-7.87	-3.55
10500	-6.37	-8.75	-3.99
12000	-8.54	-11.53	-5.56
13500	-10.93	-14.45	-7.41

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
15000	-13.41	-17.41			-9.41
<b>FC11317 (11.317 Gb/s) Reference Receiver setting frequency response (dB) (Opt 10GP)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41

**80C12B-10G Test Record**

Print a copy of this test record for each 80C12B module that you are testing.

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level</b>					
<b>1550 nm (C1 at 3 <math>\mu</math>W/div)</b>	FC8500	-1.0 $\mu$ W			+1.0 $\mu$ W
	8GFC	-1.0 $\mu$ W			+1.0 $\mu$ W
	OC-192/STM-64	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-W	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-R	-1.0 $\mu$ W			+1.0 $\mu$ W
	40GBASE-R4	-1.0 $\mu$ W			+1.0 $\mu$ W
	100GBASE-R10	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.66 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.17 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC11.10 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC11317	-1.0 $\mu$ W			+1.0 $\mu$ W
	12 GHz	-1.0 $\mu$ W			+1.0 $\mu$ W
<b>1330 nm (C1 at 3 <math>\mu</math>W/div)</b>	FC8500	-1.0 $\mu$ W			+1.0 $\mu$ W
	8GFC	-1.0 $\mu$ W			+1.0 $\mu$ W
	OC-192/STM-64	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-W	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-R	-1.0 $\mu$ W			+1.0 $\mu$ W
	40GBASE-R4	-1.0 $\mu$ W			+1.0 $\mu$ W
	100GBASE-R10	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.66 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.17 Gb/s	none			+1.0 $\mu$ W
	FEC11.10 Gb/s	none			+1.0 $\mu$ W
	FC11317	none			+1.0 $\mu$ W
	12 GHz	none			+1.0 $\mu$ W

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
850 nm (C1 at 3 $\mu$ W/div)	FC8500	-1.0 $\mu$ W			+1.0 $\mu$ W
	8GFC	-1.0 $\mu$ W			+1.0 $\mu$ W
	OC-192/STM-64	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-W	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-R	-1.0 $\mu$ W			+1.0 $\mu$ W
	40GBASE-R4	-1.0 $\mu$ W			+1.0 $\mu$ W
	100GBASE-R10	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.66 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.17 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC11.10 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC11317	-1.0 $\mu$ W			+1.0 $\mu$ W
	12 GHz	-1.0 $\mu$ W			+1.0 $\mu$ W
Vertical equivalent optical noise					
1550 nm (C1 at 3 $\mu$ W/div)	FC8500	none			2.4 $\mu$ W <sub>RMS</sub>
	8GFC	none			2.4 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			2.4 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			2.4 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			2.4 $\mu$ W <sub>RMS</sub>
	40GBASE-R4	none			2.4 $\mu$ W <sub>RMS</sub>
	100GBASE-R10	none			2.4 $\mu$ W <sub>RMS</sub>
	10GFC	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC10.66 Gb/s	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC10.17 Gb/s	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC11.10 Gb/s	none			2.4 $\mu$ W <sub>RMS</sub>
	FC11317	none			2.4 $\mu$ W <sub>RMS</sub>
	12 GHz	none			2.9 $\mu$ W <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1310 nm (C1 at 3 μW/div)	FC8500	none			2.4 μW <sub>RMS</sub>
	8GFC	none			2.4 μW <sub>RMS</sub>
	OC-192/STM-64	none			2.4 μW <sub>RMS</sub>
	10GBASE-W	none			2.4 μW <sub>RMS</sub>
	10GBASE-R	none			2.4 μW <sub>RMS</sub>
	40GBASE-R4	none			2.4 μW <sub>RMS</sub>
	100GBASE-R10	none			2.4 μW <sub>RMS</sub>
	10GFC	none			2.4 μW <sub>RMS</sub>
	FEC10.66 Gb/s	none			2.4 μW <sub>RMS</sub>
	FEC10.17 Gb/s	none			2.4 μW <sub>RMS</sub>
	FEC11.10 Gb/s	none			2.4 μW <sub>RMS</sub>
	FC11317	none			2.4 μW <sub>RMS</sub>
	12 GHz	none			3.7 μW <sub>RMS</sub>
850 nm (C1 at 5 μW)	FC8500	none			4.0 μW <sub>RMS</sub>
	8GFC	none			4.0 μW <sub>RMS</sub>
	OC-192/STM-64	none			4.0 μW <sub>RMS</sub>
	10GBASE-W	none			4.0 μW <sub>RMS</sub>
	10GBASE-R	none			4.0 μW <sub>RMS</sub>
	40GBASE-R4	none			4.0 μW <sub>RMS</sub>
	100GBASE-R10	none			4.0 μW <sub>RMS</sub>
	10GFC	none			4.0 μW <sub>RMS</sub>
	FEC10.66 Gb/s	none			4.0 μW <sub>RMS</sub>
	FEC10.17 Gb/s	none			4.0 μW <sub>RMS</sub>
	FEC11.10 Gb/s	none			4.0 μW <sub>RMS</sub>
	FC11317	none			4.0 μW <sub>RMS</sub>
	12 GHz	none			4.8 μW <sub>RMS</sub>
Minimum optical bandwidth					
12 GHz bandwidth setting		11 GHz		none	
FC8500 (8.5 Gb/s) Reference Receiver setting frequency response (dB)					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	−0.85		+0.85	
1275	−0.11	−0.96		+0.74	
2550	−0.45	−1.30		+0.40	
3825	−1.02	−1.87		+0.17	
5100	−1.86	−2.71		−1.01	
6375	−3.00	−3.86		−2.16	
7650	−4.51	−6.19		−2.83	
8500	−5.71	−7.87		−3.55	

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
8925	-6.37	-8.75			-3.99
10200	-8.54	-11.53			-5.56
11475	-10.93	-14.45			-7.41
12750	-13.41	-17.41			-9.41
<b>8GFC (FC8500FINAL) (8.5 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1493.2	-0.11	-0.96			+0.74
2986.0	-0.45	-1.30			+0.40
4478.8	-1.02	-1.87			+0.17
5972.4	-1.86	-2.71			-1.01
7465.0	-3.00	-3.86			-2.16
8958.0	-4.51	-6.19			-2.83
9953.28	-5.71	-7.87			-3.55
10451.2	-6.37	-8.75			-3.99
11944.0	-8.54	-11.53			-5.56
13437.2	-10.93	-14.45			-7.41
14930.4	-13.41	-17.41			-9.41
<b>10GBASE-W (9.95328 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17



Instrument performance test		Minimum	Incoming	Outgoing	Maximum
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41

**10GBASE-R (10.3125 Gb/s) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	-0.85		+0.85
1500	-0.11	-0.96		+0.74
3000	-0.45	-1.30		+0.40
4500	-1.02	-1.87		+0.17
6000	-1.86	-2.71		-1.01
7500	-3.00	-3.86		-2.16
9000	-4.51	-6.19		-2.83
10000	-5.71	-7.87		-3.55
10500	-6.37	-8.75		-3.99
12000	-8.54	-11.53		-5.56
13500	-10.93	-14.45		-7.41
15000	-13.41	-17.41		-9.41

**40GBASE-R4 (10.3125 Gb/s) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	-0.85		+0.85
1500	-0.11	-0.96		+0.74
3000	-0.45	-1.30		+0.40
4500	-1.02	-1.87		+0.17
6000	-1.86	-2.71		-1.01
7500	-3.00	-3.86		-2.16
9000	-4.51	-6.19		-2.83
10000	-5.71	-7.87		-3.55
10500	-6.37	-8.75		-3.99
12000	-8.54	-11.53		-5.56
13500	-10.93	-14.45		-7.41
15000	-13.41	-17.41		-9.41

**100GBASE-R10 (10.3125 Gb/s) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
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Instrument performance test		Minimum	Incoming	Outgoing	Maximum
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83
10000	−5.71	−7.87			−3.55
10500	−6.37	−8.75			−3.99
12000	−8.54	−11.53			−5.56
13500	−10.93	−14.45			−7.41
15000	−13.41	−17.41			−9.41

**10GFC (10.51875 Gb/s) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	−0.85		+0.85
1500	−0.11	−0.96		+0.74
3000	−0.45	−1.30		+0.40
4500	−1.02	−1.87		+0.17
6000	−1.86	−2.71		−1.01
7500	−3.00	−3.86		−2.16
9000	−4.51	−6.19		−2.83
10000	−5.71	−7.87		−3.55
10500	−6.37	−8.75		−3.99
12000	−8.54	−11.53		−5.56
13500	−10.93	−14.45		−7.41
15000	−13.41	−17.41		−9.41

**10.66 Gb/s Reference Receiver frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	−0.85		+0.85
1599.8	−0.11	−0.96		+0.74
3199.2	−0.45	−1.30		+0.40
4798.6	−1.02	−1.87		+0.17
6398.9	−1.86	−2.71		−1.01
7998.0	−3.00	−3.86		−2.16
9597.7	−4.51	−6.19		−2.83
10664.0	−5.71	−7.87		−3.55
11197.5	−6.37	−8.75		−3.99
12796.9	−8.54	−11.53		−5.56

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
14396.7	-10.93	-14.45			-7.41
15996.5	-13.41	-17.41			-9.41
<b>10.71 Gb/s (G.709) Reference Receiver frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1606.6	-0.11	-0.96			+0.74
3212.8	-0.45	-1.30			+0.40
4819.0	-1.02	-1.87			+0.17
6426.0	-1.86	-2.71			-1.01
8032.0	-3.00	-3.86			-2.16
9638.4	-4.51	-6.19			-2.83
10709.2	-5.71	-7.87			-3.55
11245.0	-6.37	-8.75			-3.99
12851.1	-8.54	-11.53			-5.56
14457.7	-10.93	-14.45			-7.41
16064.4	-13.41	-17.41			-9.41
<b>FEC11.10 Gb/s (ENET11096) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10GFC FEC (11.317 Gb/s) (FC11317) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41

## 80C14 Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level</b>					
<b>1550 nm (C1 at 3 <math>\mu</math>W/div)</b>	FC8500	-1.0 $\mu$ W			+1.0 $\mu$ W
	8GFC	-1.0 $\mu$ W			+1.0 $\mu$ W
	OC-192/STM-64	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-W	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-R	-1.0 $\mu$ W			+1.0 $\mu$ W
	40GBASE-R4	-1.0 $\mu$ W			+1.0 $\mu$ W
	100GBASE-R10	-1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.66 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.17 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC11.10 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	FC11317	-1.0 $\mu$ W			+1.0 $\mu$ W
	FEC12.5 Gb/s	-1.0 $\mu$ W			+1.0 $\mu$ W
	16GFC r6.1	-1.0 $\mu$ W			+1.0 $\mu$ W
	INF14063	-1.0 $\mu$ W			+1.0 $\mu$ W
	14 GHz	-1.0 $\mu$ W			+1.0 $\mu$ W

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1330 nm (C1 at 3 $\mu$ W/div)	FC8500	–1.0 $\mu$ W			+1.0 $\mu$ W
	8GFC	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-192/STM-64	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-W	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-R	–1.0 $\mu$ W			+1.0 $\mu$ W
	40GBASE-R4	–1.0 $\mu$ W			+1.0 $\mu$ W
	100GBASE-R10	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.66 Gb/s	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.17 Gb/s	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC11.10 Gb/s	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC11317	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC12.5 Gb/s	–1.0 $\mu$ W			+1.0 $\mu$ W
	16GFC r6.1	–1.0 $\mu$ W			+1.0 $\mu$ W
	INF14063	–1.0 $\mu$ W			+1.0 $\mu$ W
	14 GHz	–1.0 $\mu$ W			+1.0 $\mu$ W
850 nm (C1 at 3 $\mu$ W/div)	FC8500	–1.0 $\mu$ W			+1.0 $\mu$ W
	8GFC	–1.0 $\mu$ W			+1.0 $\mu$ W
	OC-192/STM-64	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-W	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GBASE-R	–1.0 $\mu$ W			+1.0 $\mu$ W
	40GBASE-R4	–1.0 $\mu$ W			+1.0 $\mu$ W
	100GBASE-R10	–1.0 $\mu$ W			+1.0 $\mu$ W
	10GFC	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.66 Gb/s	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC10.17 Gb/s	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC11.10 Gb/s	–1.0 $\mu$ W			+1.0 $\mu$ W
	FC11317	–1.0 $\mu$ W			+1.0 $\mu$ W
	FEC12.5 Gb/s	–1.0 $\mu$ W			+1.0 $\mu$ W
	16GFC r6.1	–1.0 $\mu$ W			+1.0 $\mu$ W
	INF14063	–1.0 $\mu$ W			+1.0 $\mu$ W
	14 GHz	–1.0 $\mu$ W			+1.0 $\mu$ W
Vertical equivalent optical noise					

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
1550 nm (C1 at 3 $\mu$ W/div)	FC8500	none			2.4 $\mu$ W <sub>RMS</sub>
	8GFC	none			2.4 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			2.4 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			2.4 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			2.4 $\mu$ W <sub>RMS</sub>
	40GBASE-R4	none			2.4 $\mu$ W <sub>RMS</sub>
	100GBASE-R10	none			2.4 $\mu$ W <sub>RMS</sub>
	10GFC	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC10.66 Gb/s	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC10.17 Gb/s	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC11.10 Gb/s	none			2.4 $\mu$ W <sub>RMS</sub>
	FC11317	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC12.5 Gb/s	none			2.9 $\mu$ W <sub>RMS</sub>
	16GFC r6.1	none			3.7 $\mu$ W <sub>RMS</sub>
	INF14063	none			3.7 $\mu$ W <sub>RMS</sub>
	14 GHz	none			3.7 $\mu$ W <sub>RMS</sub>
1310 nm (C1 at 3 $\mu$ W/div)	FC8500	none			2.4 $\mu$ W <sub>RMS</sub>
	8GFC	none			2.4 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			2.4 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			2.4 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			2.4 $\mu$ W <sub>RMS</sub>
	40GBASE-R4	none			2.4 $\mu$ W <sub>RMS</sub>
	100GBASE-R10	none			2.4 $\mu$ W <sub>RMS</sub>
	10GFC	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC10.66 Gb/s	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC10.17 Gb/s	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC11.10 Gb/s	none			2.4 $\mu$ W <sub>RMS</sub>
	FC11317	none			2.4 $\mu$ W <sub>RMS</sub>
	FEC12.5 Gb/s	none			2.9 $\mu$ W <sub>RMS</sub>
	16GFC r6.1	none			3.7 $\mu$ W <sub>RMS</sub>
	INF14063	none			3.7 $\mu$ W <sub>RMS</sub>
	14 GHz	none			3.7 $\mu$ W <sub>RMS</sub>

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>850 nm (C1 at 5 <math>\mu</math>W)</b>	FC8500	none			4.0 $\mu$ W <sub>RMS</sub>
	8GFC	none			4.0 $\mu$ W <sub>RMS</sub>
	OC-192/STM-64	none			4.0 $\mu$ W <sub>RMS</sub>
	10GBASE-W	none			4.0 $\mu$ W <sub>RMS</sub>
	10GBASE-R	none			4.0 $\mu$ W <sub>RMS</sub>
	40GBASE-R4	none			4.0 $\mu$ W <sub>RMS</sub>
	100GBASE-R10	none			4.0 $\mu$ W <sub>RMS</sub>
	10GFC	none			4.0 $\mu$ W <sub>RMS</sub>
	FEC10.66 Gb/s	none			4.0 $\mu$ W <sub>RMS</sub>
	FEC10.17 Gb/s	none			4.0 $\mu$ W <sub>RMS</sub>
	FEC11.10 Gb/s	none			4.0 $\mu$ W <sub>RMS</sub>
	FC11317	none			4.0 $\mu$ W <sub>RMS</sub>
	FEC12.5 Gb/s	none			4.8 $\mu$ W <sub>RMS</sub>
	16GFC r6.1	none			6.0 $\mu$ W <sub>RMS</sub>
	INF14063	none			6.0 $\mu$ W <sub>RMS</sub>
	14 GHz	none			6.0 $\mu$ W <sub>RMS</sub>
<b>Minimum optical bandwidth</b>					
14 GHz bandwidth setting		13 GHz			none

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>FC8500 (8.5 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1275	-0.11	-0.96			+0.74
2550	-0.45	-1.30			+0.40
3825	-1.02	-1.87			+0.17
5100	-1.86	-2.71			-1.01
6375	-3.00	-3.86			-2.16
7650	-4.51	-6.19			-2.83
8500	-5.71	-7.87			-3.55
8925	-6.37	-8.75			-3.99
10200	-8.54	-11.53			-5.56
11475	-10.93	-14.45			-7.41
12750	-13.41	-17.41			-9.41
<b>8GFC (FC8500FINAL) (8.5 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74



Instrument performance test		Minimum	Incoming	Outgoing	Maximum
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>OC-192/STM-64 (9.953 Gb/s) Reference Receiver setting frequency response (dB)</b>					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	-0.85			+0.85
1493.2	-0.11	-0.96			+0.74
2986.0	-0.45	-1.30			+0.40
4478.8	-1.02	-1.87			+0.17
5972.4	-1.86	-2.71			-1.01
7465.0	-3.00	-3.86			-2.16
8958.0	-4.51	-6.19			-2.83
9953.28	-5.71	-7.87			-3.55
10451.2	-6.37	-8.75			-3.99
11944.0	-8.54	-11.53			-5.56
13437.2	-10.93	-14.45			-7.41
14930.4	-13.41	-17.41			-9.41
<b>10GBASE-W (9.95328 Gb/s) Reference Receiver setting frequency response (dB)</b>					
Frequency (MHz)	Nominal response (dB)				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>10GBASE-R (10.3125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83
10000	−5.71	−7.87			−3.55
10500	−6.37	−8.75			−3.99
12000	−8.54	−11.53			−5.56
13500	−10.93	−14.45			−7.41
15000	−13.41	−17.41			−9.41
<b>40GBASE-R4 (10.3125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83
10000	−5.71	−7.87			−3.55
10500	−6.37	−8.75			−3.99
12000	−8.54	−11.53			−5.56
13500	−10.93	−14.45			−7.41
15000	−13.41	−17.41			−9.41
<b>100GBASE-R10 (10.3125 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	−0.85			+0.85
1500	−0.11	−0.96			+0.74
3000	−0.45	−1.30			+0.40
4500	−1.02	−1.87			+0.17
6000	−1.86	−2.71			−1.01
7500	−3.00	−3.86			−2.16
9000	−4.51	−6.19			−2.83
10000	−5.71	−7.87			−3.55

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10GFC (10.51875 Gb/s) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1500	-0.11	-0.96			+0.74
3000	-0.45	-1.30			+0.40
4500	-1.02	-1.87			+0.17
6000	-1.86	-2.71			-1.01
7500	-3.00	-3.86			-2.16
9000	-4.51	-6.19			-2.83
10000	-5.71	-7.87			-3.55
10500	-6.37	-8.75			-3.99
12000	-8.54	-11.53			-5.56
13500	-10.93	-14.45			-7.41
15000	-13.41	-17.41			-9.41
<b>10.66 Gb/s Reference Receiver frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1599.8	-0.11	-0.96			+0.74
3199.2	-0.45	-1.30			+0.40
4798.6	-1.02	-1.87			+0.17
6398.9	-1.86	-2.71			-1.01
7998.0	-3.00	-3.86			-2.16
9597.7	-4.51	-6.19			-2.83
10664.0	-5.71	-7.87			-3.55
11197.5	-6.37	-8.75			-3.99
12796.9	-8.54	-11.53			-5.56
14396.7	-10.93	-14.45			-7.41
15996.5	-13.41	-17.41			-9.41
<b>10.71 Gb/s (G.709) Reference Receiver frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
1606.6	-0.11	-0.96			+0.74
3212.8	-0.45	-1.30			+0.40
4819.0	-1.02	-1.87			+0.17

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
6426.0	-1.86	-2.71			-1.01
8032.0	-3.00	-3.86			-2.16
9638.4	-4.51	-6.19			-2.83
10709.2	-5.71	-7.87			-3.55
11245.0	-6.37	-8.75			-3.99
12851.1	-8.54	-11.53			-5.56
14457.7	-10.93	-14.45			-7.41
16064.4	-13.41	-17.41			-9.41

**FEC11.10 Gb/s (ENET11096) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	-0.85		+0.85
1500	-0.11	-0.96		+0.74
3000	-0.45	-1.30		+0.40
4500	-1.02	-1.87		+0.17
6000	-1.86	-2.71		-1.01
7500	-3.00	-3.86		-2.16
9000	-4.51	-6.19		-2.83
10000	-5.71	-7.87		-3.55
10500	-6.37	-8.75		-3.99
12000	-8.54	-11.53		-5.56
13500	-10.93	-14.45		-7.41
15000	-13.41	-17.41		-9.41

**10GFC FEC (11.317 Gb/s) (FC11317) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
0.00	0.00	-0.85		+0.85
1500	-0.11	-0.96		+0.74
3000	-0.45	-1.30		+0.40
4500	-1.02	-1.87		+0.17
6000	-1.86	-2.71		-1.01
7500	-3.00	-3.86		-2.16
9000	-4.51	-6.19		-2.83
10000	-5.71	-7.87		-3.55
10500	-6.37	-8.75		-3.99
12000	-8.54	-11.53		-5.56
13500	-10.93	-14.45		-7.41
15000	-13.41	-17.41		-9.41

**FEC12.50 Gb/s (FEC12500) Reference Receiver setting frequency response (dB)**

Frequency (MHz)	Nominal response (dB)			
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Instrument performance test		Minimum	Incoming	Outgoing	Maximum
0.00	0.00	-0.85			+0.85
1875	-0.11	-0.96			+0.74
3750	-0.45	-1.30			+0.40
5625	-1.02	-1.87			+0.17
7500	-1.86	-2.71			-1.01
9375	-3.00	-3.86			-2.16
11250	-4.51	-6.19			-2.83
12500	-5.71	-7.87			-3.55
13125	-6.37	-8.75			-3.99
15000	-8.54	-11.53			-5.56
16875	-10.93	-14.45			-7.41
18750	-13.41	-17.41			-9.41

#### 16GFC r6.1 (FC14025) Data Filter frequency response (dB)

Frequency (GHz)	Nominal response (dB)			
0.00	0.00	-0.85		+0.85
1.845	-0.085	-0.935		+0.765
3.690	-0.344	-1.194		+0.506
5.535	-0.783	-1.633		+0.067
7.380	-1.416	-2.266		-0.566
9.225	-2.267	-3.117		-1.417
10.519	-3.00	-4.68		-1.66
11.070	-3.368	-5.357		-1.821
12.915	-4.746	-7.698		-2.610
14.025	-5.71	-9.18		-3.26
14.760	-6.402	-10.189		-3.756
16.605	-8.299	-12.281		-5.203
18.450	-10.366	-15.546		-6.867
20.295	-12.527	-18.303		-8.664
21.308	-13.41	-19.41		-9.41

#### INF14063 (14.0625 Gb/s) Data Filter frequency response (dB)

Frequency (GHz)	Nominal response (dB)			
0.00	0.00	-0.85		+0.85
1.850	-0.085	-0.935		+0.765
3.700	-0.344	-1.194		+0.506
5.550	-0.783	-1.633		+0.067
7.400	-1.416	-2.266		-0.566
9.250	-2.267	-3.117		-1.417
10.547	-3.00	-4.68		-1.66

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
11.100	-3.368	-5.357			-1.821
12.950	-4.746	-7.698			-2.610
14.065	-5.71	-9.18			-3.26
14.800	-6.402	-10.189			-3.756
16.650	-8.299	-12.281			-5.203
18.500	-10.366	-15.546			-6.867
20.350	-12.527	-18.303			-8.664
21.095	-13.41	-19.41			-9.41

## 80C25BGE Test Record

Module Serial Number:

Certificate Number:

Temperature:

RH %:

Module Calibration Date:

Technician:

Module Test Date:

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
<b>Dark level</b>					
<b>1550 nm (C1 at 50 <math>\mu</math>W)</b>	65 GHz	-25 $\mu$ W			+25 $\mu$ W
	100GBase-R4	-25 $\mu$ W			+25 $\mu$ W
	100GBase-R4 FEC	-25 $\mu$ W			+25 $\mu$ W
<b>1310 nm (C1 at 80 <math>\mu</math>W)</b>	65 GHz	-35 $\mu$ W			+35 $\mu$ W
	100GBase-R4	-35 $\mu$ W			+35 $\mu$ W
	100GBase-R4 FEC	-35 $\mu$ W			+35 $\mu$ W
<b>Vertical equivalent optical noise</b>					
<b>1550 nm (C1 at 50 <math>\mu</math>W)</b>	65 GHz	none			60 $\mu$ W <sub>RMS</sub>
	100GBase-R4	none			28 $\mu$ W <sub>RMS</sub>
	100GBase-R4 FEC	none			28 $\mu$ W <sub>RMS</sub>
<b>1310 nm (C1 at 50 <math>\mu</math>W)</b>	65 GHz	none			75 $\mu$ W <sub>RMS</sub>
	100GBase-R4	none			38 $\mu$ W <sub>RMS</sub>
	100GBase-R4 FEC	none			38 $\mu$ W <sub>RMS</sub>
<b>Minimum optical bandwidth</b>					
65 GHz bandwidth setting		60 GHz			none
<b>100GBase-R4 (25.781 Gb/s, ENET25781) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				
0.00	0.00	-0.85			+0.85
3750	-0.11	-0.96			+0.74
7500	-0.45	-1.30			+0.40
11250	-1.02	-1.87			+0.17
15000	-1.86	-2.71			-1.01
18750	-3.00	-3.86			-2.16
22500	-4.51	-6.19			-2.83
25000	-5.71	-7.87			-3.55
26250	-6.37	-8.75			-3.99
30000	-8.54	-11.53			-5.56
33750	-10.93	-14.45			-7.41
37500	-13.41	-17.41			-9.41
<b>100GBase-R4 FEC (27.739 Gb/s, ENET27739) Reference Receiver setting frequency response (dB)</b>					
<i>Frequency (MHz)</i>	<i>Nominal response (dB)</i>				

Instrument performance test		Minimum	Incoming	Outgoing	Maximum
0.00	0.00	−0.85			+0.85
3750	−0.11	−0.96			+0.74
7500	−0.45	−1.30			+0.40
11250	−1.02	−1.87			+0.17
15000	−1.86	−2.71			−1.01
18750	−3.00	−3.86			−2.16
22500	−4.51	−6.19			−2.83
25000	−5.71	−7.87			−3.55
26250	−6.37	−8.75			−3.99
30000	−8.54	−11.53			−5.56
33750	−10.93	−14.45			−7.41
37500	−13.41	−17.41			−9.41
<b>Aberrations (peak to peak)</b>					
<b>Filter or bandwidth</b>	65 GHz	none			10%
	100GBase-R4	none			5%
	100GBase-R4 FEC	none			5%

## 80A02 EOS/ESD Protection Module Test Record

Photocopy this page and use it to record the performance test results for your 80A02 Test Record.

### 80A02 Test Record.

Module Serial Number:		Certificate Number:			
Temperature:		RH %:			
Date of Calibration:		Technician:			
<b>Performance Test</b>	<b>Minimum</b>	<b>Incoming</b>	<b>Outgoing</b>	<b>Maximum</b>	
<i>Logic control threshold level</i>					
Engaged, LED lights	1 V			5 V	
Disengaged, LED does not light	0 V			300 mV	



## 80A05 Electrical Clock Recovery Module Test Record

Photocopy this and the next page and use them to record the performance test results for your 80A05 Test Record.

### 80A05 Test Record.

Module Serial Number:		Certificate Number:		
Temperature:		RH %		
Date of Calibration:		Technician:		
Performance Test		Minimum	Incoming	Outgoing
<i>Clock recovery sensitivity</i>				
Rate: OC-3	Horz Scale: 1 ns	10 mV		none
Rate: OC-12	Horz Scale: 500 ps	10 mV		none
Rate: FC-1063	Horz Scale: 200 ps	10 mV		none
Rate: GBE	Horz Scale: 200 ps	10 mV		none
Rate: Serial ATA (1.50 Gb/s)	Horz Scale: 200 ps	10 mV		none
Rate: FC2125	Horz Scale: 100 ps	10 mV		none
Rate: OC-48	Horz Scale: 100 ps	10 mV		none
Rate: 2GBE	Horz Scale: 100 ps	10 mV		none
Rate: Infiniband	Horz Scale: 100 ps	10 mV		none
Rate: PCI Express	Horz Scale: 100 ps	10 mV		none
Rate: 2.5 G G.709 FEC	Horz Scale: 100 ps	10 mV		none
Rate: Serial ATA (3.00 Gb/s)	Horz Scale: 100 ps	15 mV		none
Rate: XAUI (3.125 Gb/s)	Horz Scale: 100 ps	15 mV		none
Rate: FibreChannel	Horz Scale: 100 ps	15 mV		none
Rate: VSR5	Horz Scale: 100 ps	15 mV		none
Rate: 4 Gigabit FibreChannel	Horz Scale: 100 ps	15 mV		none
Rate: Serial ATA (6.00 Gb/s) (option 10G)	Horz Scale: 50 ps	15 mV		none
Rate: XAUI (6.25 Gb/s) (option 10G)	Horz Scale: 50 ps	15 mV		none
Rate: OC-192 (option 10G)	Horz Scale: 50 ps	15 mV		none
Rate: 10GBASE-W (option 10G)	Horz Scale: 50 ps	15 mV		none
Rate: 10GBASE-R (option 10G)	Horz Scale: 50 ps	15 mV		none
Rate: 10GFC (option 10G)	Horz Scale: 50 ps	15 mV		none
Rate: G.975 FEC (option 10G)	Horz Scale: 50 ps	15 mV		none
Rate: G.709 FEC (option 10G)	Horz Scale: 50 ps	15 mV		none

Performance Test		Minimum	Incoming	Outgoing	Maximum
Rate: 10GbE w/FEC (option 10G)	Horz Scale: 50 ps	15 mV			none
Rate: Super FEC (option 10G)	Horz Scale: 50 ps	20 mV			none
<i>Recovered clock timing jitter</i>					
Rate: OC-3	Horz Scale: 1 ns	none			64 ps
Rate: OC-12	Horz Scale: 500 ps	none			16 ps
Rate: FC-1063	Horz Scale: 200 ps	none			9.4 ps
Rate: GBE	Horz Scale: 200 ps	none			8 ps
Rate: Serial ATA (1.50 Gb/s)	Horz Scale: 200 ps	none			6.7 ps
Rate: FC2125	Horz Scale: 100 ps	none			4.7 ps
Rate: OC-48	Horz Scale: 100 ps	none			4 ps
Rate: 2GBE	Horz Scale: 100 ps	none			4 ps
Rate: Infiniband	Horz Scale: 100 ps	none			4 ps
Rate: PCI Express	Horz Scale: 100 ps	none			4 ps
Rate: 2.5 G G.709 FEC	Horz Scale: 100 ps	none			4 ps
Rate: Serial ATA (3.00 Gb/s)	Horz Scale: 100 ps	none			2.5 ps
Rate: XAUI (3.125 Gb/s)	Horz Scale: 100 ps	none			2.5 ps
Rate: FibreChannel	Horz Scale: 100 ps	none			2.5 ps
Rate: VSR5	Horz Scale: 100 ps	none			2.5 ps
Rate: 4 Gigabit FibreChannel	Horz Scale: 100 ps	none			2.5 ps
Rate: Serial ATA (6.00 Gb/s) (option 10G)	Horz Scale: 50 ps	none			2 ps
Rate: XAUI (6.25 Gb/s) (option 10G)	Horz Scale: 50 ps	none			2 ps
Rate: OC-192 (option 10G)	Horz Scale: 50 ps	none			2 ps
Rate: 10GBASE-W (option 10G)	Horz Scale: 50 ps	none			2 ps
Rate: 10GBASE-R (option 10G)	Horz Scale: 50 ps	none			2 ps
Rate: 10GFC (option 10G)	Horz Scale: 50 ps	none			2 ps
Rate: G.975 FEC (option 10G)	Horz Scale: 50 ps	none			2 ps
Rate: G.709 FEC (option 10G)	Horz Scale: 50 ps	none			2 ps
Rate: 10GbE w/FEC (option 10G)	Horz Scale: 50 ps	none			2 ps
Rate: Super FEC (option 10G)	Horz Scale: 50 ps	none			2 ps

# Main Instrument

These procedures check the main instrument specifications that are listed as checked in the *DSA8300 Digital Serial Analyzer Specifications* manual.

## Prerequisites

Be sure you have performed the *Prerequisites* before doing any procedures in this section. (See page 1-17, *Prerequisites*.)

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**NOTE.** Use a torque wrench when connecting the terminators, adapters, attenuator, and power sensor in this setup. Use  $8 \pm 0.3$  inch pounds of torque.

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**NOTE.** Throughout these procedures, when steps call for the display of setup dialog boxes, you can display them from the Setup menu in the menu bar at the top of the screen. These procedures assume you will display and dismiss the setup dialog boxes as needed.

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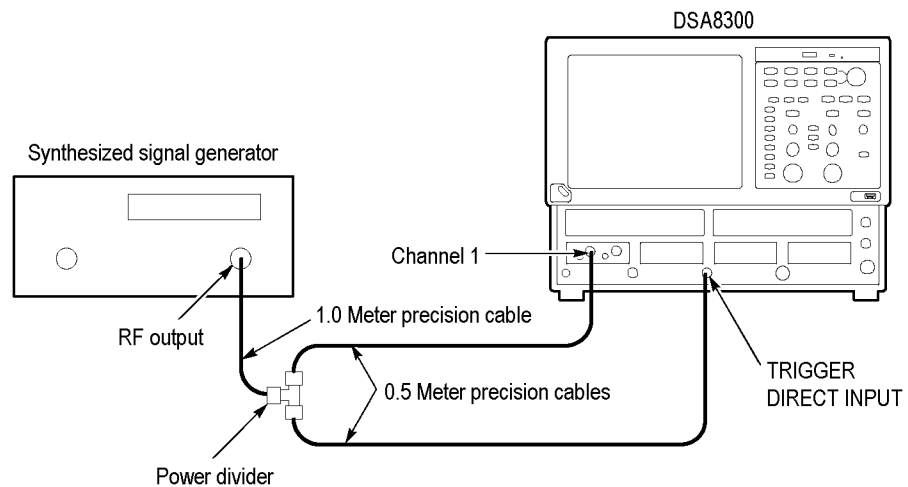
**NOTE.** The procedures throughout this chapter contain instructions based on the menus and controls from the most updated instrument software available at the time this document was released. These procedures will work for other versions of software, but some control and menu names may vary slightly.

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## Time Interval Accuracy, Direct and Clock Trigger

<b>Equipment required</b> (See Table 1-1.)	0.5 meter precision SMA cable (item 15)
	1.0 meter precision SMA cable (item 16)
	Power divider (item 26)
	Synthesized signal generator (item 31)
	Electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, or 80E10)
<b>Prerequisites</b>	As listed under <i>Prerequisites</i> . (See page 1-17, <i>Prerequisites</i> .)

## Setup



**Figure 1-6: Time interval accuracy test setup**

1. Install the 80E0X module(s) to test starting at the left-most small module slot as shown in the figure. Power on the instrument and wait 20 minutes for warm-up.
2. Connect the synthesized signal generator to a 1.0 meter cable.
3. Connect the remaining end of the 1.0 meter cable to a 50  $\Omega$  SMA power divider. Connect two 0.5 meter cables to the two remaining SMA power divider connectors.
4. Connect one of the 0.5 meter cables to Channel 1 of the 80E0X module. Connect the remaining 0.5 meter cable to the TRIGGER DIRECT INPUT.
5. Set the synthesized signal generator frequency to 1 GHz.

6. Set the Synthesized output to **800 mV<sub>p-p</sub>** (400 mV displayed)
7. Set up the instrument as follows:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select **C1** from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
  - c. In the **Setup > Mode/Trigger** Setup dialog box:
    - Select **Direct** for Trigger Source.
  - d. Click the **Vert** tab and set the following:
    - Set the Scale to **100 mV/div**.
    - Set the Offset to **0**.
  - e. Click the **Horz** tab and set the following:
    - Set the Scale to **200 ps/div**.
    - Set Position to **19 ns** (29 ns if using 80E07, 80E08, 80E09, or 80E10).
    - Set Horizontal Reference to **0%**.
  - f. Click the **Acq** tab and set Acquisition Mode to **Average**.

**Test** Follow this procedure to make the time interval accuracy check:

1. Click the **Meas** tab and set the following:
2. Select **Meas 1**.
3. Click the **Source1** button.
4. In the Source tab, make sure the channel under test is selected and click the **Pulse Signal Type** button.
5. Click **Select Meas > Pulse – Amplitude > Amplitude**.
6. Click **Meas 2**.
7. Click the **Source1** button.
8. In the Source tab, make sure the channel under test is selected and click the **Pulse Signal Type** button.
9. Click **Select Meas > Pulse – Timing > Period**.
10. Adjust the synthesizer signal generator level until the amplitude measurement readout on the instrument screen is **400 mV**.
11. Verify that the period measurement readout value is **1 ns ±9 ps**. Record the value in the *Time Interval Accuracy, Trigger Direct Input connector* test record field.

12. Click the **HORZ** tab, set the Horizontal Position field to **100 ns**, and verify that the period measurement readout value is **1 ns  $\pm$ 9 ps**. Record the value in the *Time Interval Accuracy, Trigger Direct Input connector* test record field.
13. Set the Horizontal Position field to **1  $\mu$ s** and verify that the period measurement readout value is **1 ns  $\pm$ 9 ps**. Record the value in the *Time Interval Accuracy, Trigger Direct Input connector* test record field.
14. Disconnect the 0.5 m cable from the TRIGGER DIRECT INPUT connector and connect it to the **CLOCK INPUT/PRESCALE TRIGGER** input.
15. Click the **Mode/Trigger** tab and click the **Clock** trigger source button.
16. Click the **Eye** button (Scope Mode (Clock Trigger Source) area).
17. Click the **Clear Data** button (application toolbar; looks like a red and white eraser).
18. Click the **Horz** tab and set the Position field to **19 ns** (29 ns if using 80E07, 80E08, 80E09, or 80E10).
19. Repeat steps 11 through 13. Record the value in the *Time Interval Accuracy, Clock Input/Prescale Trigger connector; Eye mode* test record field.
20. Click the **Mode/Trigger** tab and click the **Other** button (Scope Mode (Clock Trigger Source) area).
21. Click the **Horz** tab and verify/set the Position field to **19 ns** (29 ns if using 80E07, 80E08, 80E09, or 80E10).
22. Repeat steps 11 through 13. Record the value in the *Time Interval Accuracy, Clock Input/Prescale Trigger connector; Other mode* test record field.

*End of Procedure*

## External Trigger Direct Level Accuracy

<b>Equipment required</b> (See Table 1-1.)	0.5 meter precision SMA cable (item 15)
	1.0 meter precision SMA cable (item 16)
	Power divider (item 26)
	Synthesized signal generator (item 31)
	Electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, or 80E10)
<b>Prerequisites</b>	As listed under <i>Prerequisites</i> . (See page 1-17, <i>Prerequisites</i> .)

## Setup

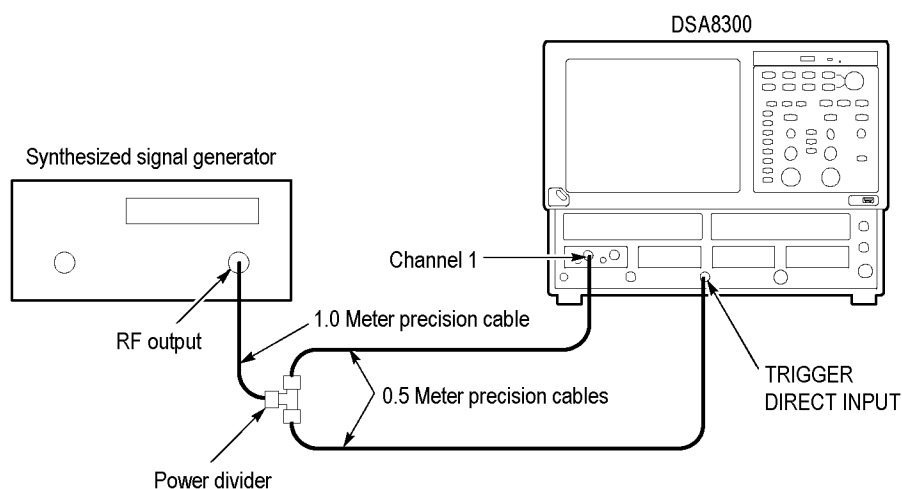


Figure 1-7: External direct trigger test setup

1. Install the 80E0X module(s) to test starting at the left-most small module slot as shown in the figure. Power on the instrument and wait 20 minutes for warm-up.
2. Connect the test equipment (See Figure 1-7.)
3. Set the synthesized signal generator:
  - Frequency to **100 MHz (10 ns period)**.
  - Output to **1600 mV<sub>p-p</sub>** (800 mV displayed).
4. Set the DSA8300 as follows:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select **C1** from the Waveform Selector menu (left end of controls bar at bottom of the graticule).
  - c. Click **Setup > Mode/Trigger** and select **Direct** for Trigger Source.
  - d. Click the **Vert** tab and set the following:
    - Scale to **100 mV/div**.
    - Offset to **0**.
  - e. Click the **Horz** tab and set the following:
    - Scale to **5 ns/division**.
    - Position to the minimum possible value.
    - Horizontal Reference to **0%**.

- Test** Follow this procedure to make the direct trigger level accuracy check:
1. Click the **Meas** tab.
  2. Select **Meas 1**.
  3. Click the **Source1** button.
  4. Make sure the channel under test is selected in the **Source** tab
  5. Click the **Pulse** button (Signal Type area).
  6. Click **Select Meas > Pulse – Amplitude > Amplitude**.
  7. Adjust the synthesizer signal generator level until the amplitude measurement readout on the instrument shows **800 mV**.

---

**NOTE.** *A stable trigger results in a uniform, regular waveform 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. The following step represents approximately 180° phase shift. Verify that the trigger is operating (stable).*

---

8. Click the **Mode/Trigger** tab and click **Advanced Trigger Setup**. Set the slope to **Falling**. Verify the trigger is stable and that the waveform position changes by **4.6 ns** to **5.4 ns**.
9. Set the slope to **Rising** and close the Advanced Trigger Setup dialog box.
10. In the Mode/Trigger Setup dialog box, adjust the Direct trigger Level field from **–100 mV** to **+100 mV**.

Verify the waveform position changes between **625 ps** and **1 ns** as the level is changed between **–100 mV** to **+100 mV**. (With positive slope, the waveform shifts to the right.)

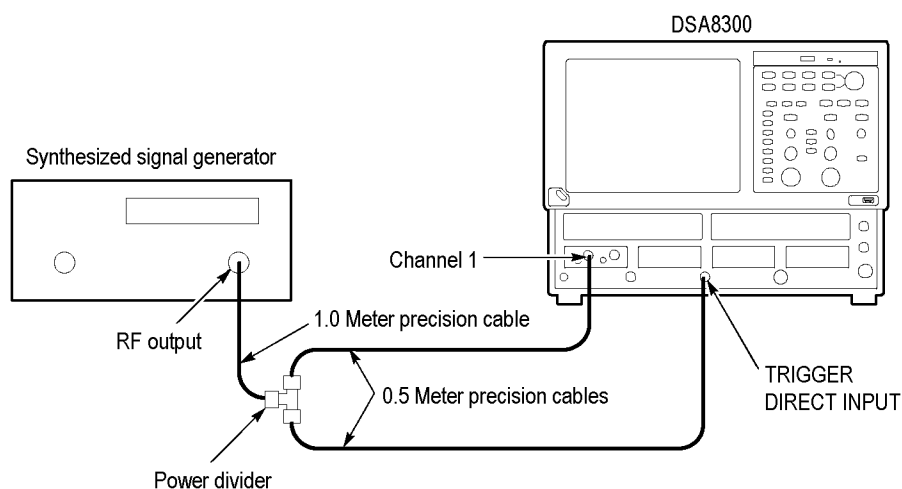
*End of Procedure*

## External Direct Trigger Sensitivity

<b>Equipment required</b> (See Table 1-1.)	0.5 meter precision SMA cable (item 15)
	1.0 meter precision SMA cable (item 16)
	Power divider (item 26)
	Synthesized signal generator (item 31)
	Electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, or 80E10)
<b>Prerequisites</b>	As listed under <i>Prerequisites</i> . (See page 1-17, <i>Prerequisites</i> .)



## Setup



**Figure 1-8: External direct trigger sensitivity test setup**

1. Install the 80E0X module(s) to test starting at the left-most small module slot as shown in the figure. Power on the instrument and wait 20 minutes for warm-up.
2. Connect the test equipment (See Figure 1-8.)
3. Set the synthesized signal generator frequency as follows:
  - Frequency to **2.5 GHz** (400 ps period).
  - Output to **400 mV<sub>p-p</sub>** (200 mV displayed).
4. Set the DSA8300 as follows:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select **C1** from the Waveform Selector menu (left end of controls bar at bottom of the graticule).
  - c. Select **Setup > Mode/Trigger** and select **Direct** for Trigger Source.
  - d. Click the **Vert** tab and set the following:
    - Scale to **20 mV/div**.
    - Offset to **0**.
  - e. Click the **Horz** tab and set the following:
    - Scale to **200 ps/division**.
    - Position to **19 ns** (29 ns if using 80E07, 80E08, 80E09, 80E10).
    - Horizontal Reference to **0%**.

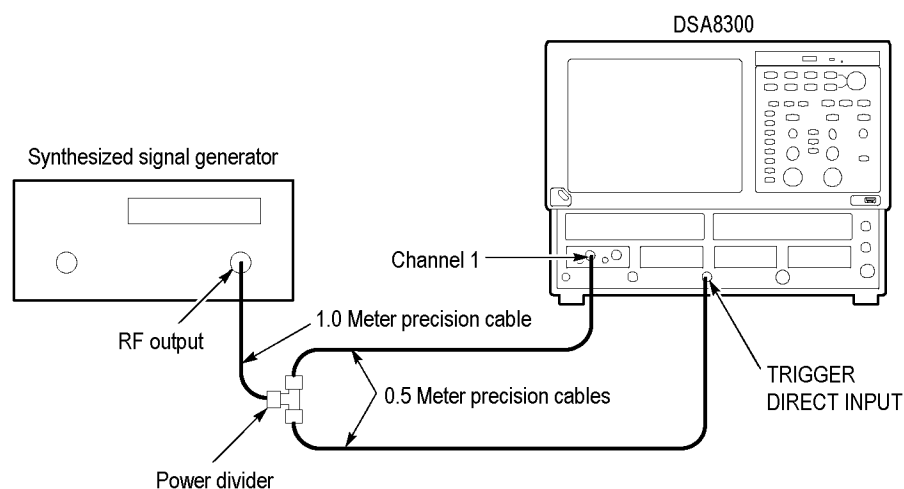
- Test** Follow this procedure to make the direct trigger sensitivity check:
1. Click the **Meas** tab.
  2. Select **Meas 1**.
  3. Click the **Source1** button.
  4. Make sure the channel under test is selected in the **Source** tab
  5. Click the **Pulse** button (Signal Type area).
  6. Click **Select Meas > Pulse – Amplitude > Amplitude**.
  7. Click **Meas 2**.
  8. Click the **Source1** button.
  9. In the Source tab, make sure the channel under test is selected and click the **Pulse** Signal Type button.
  10. Click **Select Meas > Pulse – Timing > Frequency**.
  11. Adjust the synthesizer signal generator level until the amplitude measurement readout on the instrument shows **100 mV**.
  12. Set the signal generator frequency to **100 MHz**.
  13. Adjust the Horizontal **SCALE** knob to display at least two full periods.
  14. Verify that the frequency readout value is within **10%** of the true value.
  15. Set the signal generator frequency to each of the following values, adjust the horizontal scale to the corresponding seconds/div setting, and repeat steps 13 and 14:
    - 800 MHz at 500 ps/div
    - 1 GHz at 500 ps/div
    - 2 GHz at 200 ps/div
    - 3 GHz at 100 ps/div

*End of Procedure*

## External Trigger Direct Input Connector Delay Jitter

<b>Equipment required</b> (See Table 1-1.)	0.5 meter precision SMA cable (item 15)
	1.0 meter precision SMA cable (item 16)
	Power divider (item 26)
	Synthesized signal generator (item 31)
	Electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, or 80E10)
<b>Prerequisites</b>	As listed under <i>Prerequisites</i> . (See page 1-17, <i>Prerequisites</i> .)

## Setup



**Figure 1-9: External Trigger Direct Input jitter test setup**

1. Install the 80E0X module(s) to test starting at the left-most small module slot as shown in the figure. Power on the instrument and wait 20 minutes for warm-up.
2. Connect the test equipment (See Figure 1-9.)
3. Set the synthesized signal generator as follows:
  - Frequency to **2.5 GHz**.
  - Output to **1.6 V<sub>p-p</sub>** (800 mV<sub>p-p</sub> displayed).
4. Set the DSA8300 as follows:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select **C1** from the Waveform Selector menu (left end of controls bar at bottom of the graticule).
  - c. Click **Setup > Mode/Trigger** and select **Direct** for the Trigger Source.
  - d. Click the **Vert** tab and set the following:
    - Scale to **100 mV/div**.
    - Offset to **0**.
  - e. Click the **Horz** tab and set the following:
    - Scale to **200 ps/division**.
    - Position to **19 ns** (29 ns if using 80E07, 80E08, 80E09, 80E10).
    - Record Length to **2000**.
    - Horizontal Reference to **0%**.

**Test** Follow this procedure to check the direct trigger delay jitter:

1. Click the **Meas** tab.
2. Select **Meas 1**.
3. Click the **Source1** button.
4. Make sure the channel under test is selected in the **Source** tab
5. Click the **Pulse** button (Signal Type area).
6. Click **Select Meas > Pulse – Amplitude > Amplitude**.
7. Select **Meas 2**.
8. Click the **Source1** button.
9. Make sure the channel under test is selected in the **Source** tab
10. Click the **Pulse** button (Signal Type area).
11. Click **Select Meas > Pulse – Timing > RMS Jitter**. Dismiss any database notification messages that are displayed.
12. Verify that **Use Wfm Database** is selected (in the Source tab area); if not, select it.
13. Click the **Wfm Database** tab and select **Display** (in the Database area).

---

**NOTE.** The instrument will select whichever of the two databases that is not in use. Turn on Display Database for the database that shows the current channel in the Source box. Deselect Database On for the other database.

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14. Set the Horizontal Scale to **5 ps/div** and position the rising edge until it goes through the center of the display (where the center horizontal and vertical graticules cross).
15. Set the Vertical Scale to **10 mV/div**.
16. Click the **Acq** tab and set the following:
  - Stop After to **Condition**.
  - Number of Acquisitions to **400**. See the *DSA8300 online help* for information on setting acquisition modes.
17. Push the **CLEAR DATA** front-panel button, and then push the **RUN/STOP** button. The instrument takes 400 acquisitions and stops. This acquisition takes a couple of seconds.
18. Verify that the RMS Jitter measurement readout value is less than **1.5 ps**.
19. Click the **Horz** tab and set Timebase Position field to **100 ns**.

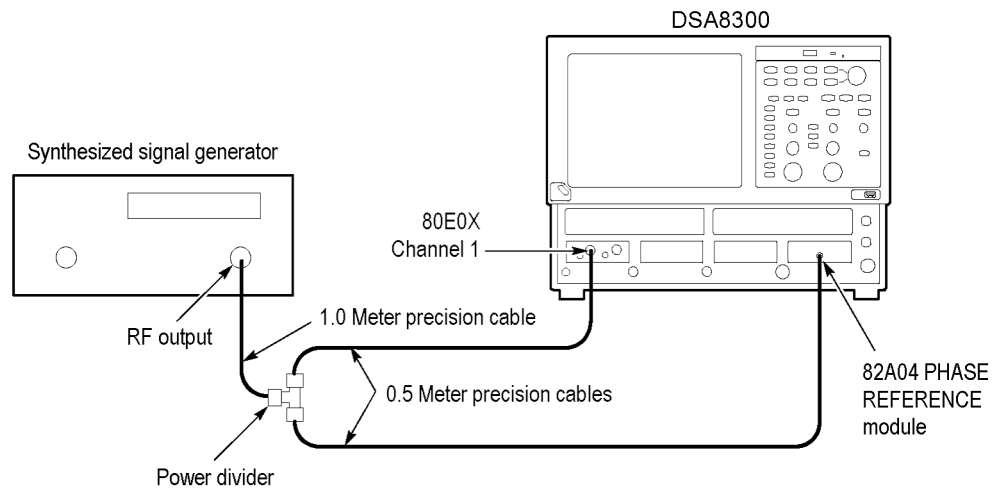
20. Click the **Acq** tab and set Stop After to **Run/Stop Button Only**.
21. Push **RUN/STOP** until it toggles to green. Position the rising edge of the waveform so that it goes through the center of the display graticule.
22. Set Stop After to **Condition** (Acq tab).
23. Push **CLEAR DATA**, push **RUN/STOP**, and wait for the acquisition to stop.
24. Verify that the RMS Jitter measurement readout is less than **2.5 ps**.
25. Click the **Horz** tab and set the Timebase Position parameter to **1  $\mu$ s**
26. Click the **Acq** tab and set Stop After to **Run/Stop Button Only**.
27. Push **RUN/STOP** until the button color toggles to green. Position the rising edge of the waveform so that it goes through the center of the display graticule.
28. Set Stop After to **Condition** (in the Acq tab).
29. Push **CLEAR DATA**, push **RUN/STOP**, and wait for the instrument to stop acquisition.
30. Verify that the RMS Jitter measurement is less than **11.5 ps**.
31. Move the signal source cable to the next module under test. Repeat from step for all 80E00 series modules installed. Check one input per module (for example, channels 1 and 3 if two modules are installed).
32. In Acq Setup dialog box, set Stop After to **Run/Stop Button Only** when finished.

*End of Procedure*

## Trigger Delay Jitter, Untriggered Phase Corrected Mode

<b>Equipment required</b>	82A04 Phase Reference module
(See Table 1-1.)	0.5 meter precision SMA cable (item 15)
	1.0 meter precision SMA cable (item 16)
	Power divider (item 26)
	Synthesized signal generator (item 31)
	Electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, or 80E10)
<b>Prerequisites</b>	As listed under <i>Prerequisites</i> . (See page 1-17, <i>Prerequisites</i> .)

## Setup



**Figure 1-10: Phase corrected untriggered jitter test setup**

1. Install the 82A04 Phase Reference module into the right-most small module slot of the instrument.
2. Install the 80E0X module(s) to test into the left-most small module compartments of the instrument as shown in the figure. Power on the instrument and wait 20 minutes for warm-up.
3. Connect the test equipment (See Figure 1-10.)

4. Set the synthesized signal generator as follows:
  - Frequency to **10.0 GHz**.
  - Output to **1.6 V<sub>p-p</sub>** (800 mV<sub>p-p</sub> displayed).
5. Set the DSA8300 as follows:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select the input channel of the module under test from the Waveform Selector menu (left end of controls bar at bottom of the graticule).
  - c. Select **Setup > Mode/Trigger** and set the Trigger Source to **Free Run/Untriggered Phase Ref**.
  - d. Select **Setup > Phase Ref** and set the following:
    - Phase correction mode to **Untriggered**.
    - Source to **C7\_C8**.
    - Input freq to **10.00 GHz**.
    - Click the **Characterize** button and follow the on screen instructions.
  - e. Click the **Vert** tab and set the following:
    - Scale to **100 mV/div**.
    - Offset to **0**.
  - f. Click the **Horz** tab and set the following:
    - Scale to **20 ps/div**.
    - Horizontal Reference to **0%**.
    - Position to **20 ns** (set to **29 ns** for 80E07, 80E08, 80E09, and 80E10).
    - Record Length to **2000**.

**Test** Follow this procedure to make the phase corrected jitter check:

1. Click the **Meas** tab.
2. Select **Meas 1**.
3. Click the **Source1** button.
4. Make sure the channel under test is selected in the **Source** tab
5. Click the **Pulse** button (Signal Type area).
6. Click **Select Meas > Pulse – Amplitude > Amplitude**.
7. Select **Meas 2**.
8. Click the **Source1** button.

9. Make sure the channel under test is selected in the **Source** tab
10. Click the **Pulse** button (Signal Type area).
11. Click **Select Meas > Pulse – Timing > RMS Jitter**. Dismiss any database notification messages that are displayed.
12. Verify that **Use Wfm Database** is selected (in the Source tab area); if not, select it.
13. Click the **Wfm Database** tab and select **Display** (in the Database area).

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**NOTE.** *The instrument will select whichever of the two databases that is not in use. Turn on Display Database for the database that shows the current channel in the Source box. Deselect Database On for the other database.*

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14. Set the Horizontal Scale to **2 ps/div** and position the rising edge until it goes through the center of the display graticule (where the center horizontal and vertical graticules cross).
15. Set the Vertical Scale to **5 mV/div**.
16. Click the **Acq** tab and set the following:
  - Stop After to **Condition**.
  - Number of Acquisitions to **400**.
17. Push the **CLEAR DATA** front-panel button, and then push the **RUN/STOP** button. The instrument takes 400 acquisitions and stops. This acquisition takes a couple of seconds. Note the value in the RMS Jitter measurement readout.
18. Repeat step to take several RMS Jitter readings and enter the average value on the Test Record for the module under test. Typical values are **200 fs or less**. This measurement does not have a guaranteed specification.
19. Move the signal source cable to the next module under test. Repeat from setup step for each 80E00 series modules installed. Check one input per module (for example, channels 1 and 3 if two modules are installed).
20. Disconnect the test setup.

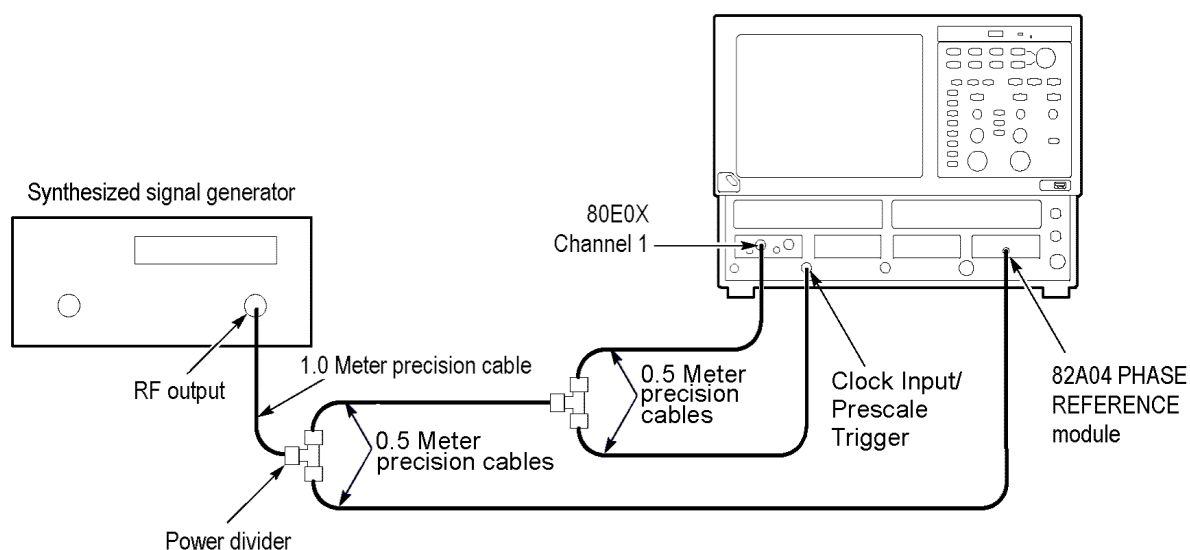
*End of Procedure*



## Trigger Delay Jitter, External Triggered Phase Corrected Mode - Clock Eye

<b>Equipment required</b> (See Table 1-1.)	82A04 Phase Reference module
	0.5 meter precision SMA cable (item 15)
	1.0 meter precision SMA cable (item 16)
	Power divider (item 26)
	Synthesized signal generator (item 31)
	Electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, and 80E10)
<b>Prerequisites</b>	As listed under <i>Prerequisites</i> . (See page 1-17, <i>Prerequisites</i> .)

### Setup



**Figure 1-11: Phase corrected, Clock Eye external triggered jitter test setup**

1. Install the 82A04 Phase Reference module into the right-most small module slot of the instrument.
2. Install the 80E0X module(s) to test into the left-most small module slots. Power on the instrument and wait 20 minutes for warm-up.
3. Connect the test equipment (See Figure 1-11.)

4. Set the synthesized signal generator as follows:
  - Frequency to **10.0 GHz**.
  - Output to **1.6 V<sub>p-p</sub>** (800 mV<sub>p-p</sub> displayed).
5. Set the DSA8300 as follows:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select the input channel of the module under test from the Waveform Selector menu (left end of controls bar at bottom of the graticule).
  - c. Click the **Mode/Trigger** tab and set the following:
    - Trigger Source to **Clock** and clock type to **Clock/Prescale**.
    - Scope Mode (Clock Trigger Source) to **Eye**.
  - d. Select **Setup > Phase Ref** and set the following:
    - Phase correction mode to **Triggered**.
    - Source to **C7\_C8**.
    - Input freq to **10.00 GHz**.
  - e. Click the **Phase Ref** tab and click the **Characterize** button. Follow the instructions.
  - f. Click the **Vert** tab and set the following:
    - Scale to **100 mV/div**.
    - Offset to **0**.
  - g. Click the **Horz** tab and set the following:
    - Scale to **20 ps/div**.
    - Horizontal Reference to **50%**.
    - Position to **20 ns** (set to **29 ns** for 80E07, 80E08, 80E09, and 80E10).
    - Record Length to **2000**.

**Test** Follow this procedure to make the Trigger Delay Jitter, Triggered Phase Corrected Mode - Clock Eye test:

1. Click the **Meas** tab.
2. Select **Meas 1**.
3. Click the **Source1** button.
4. Make sure the channel under test is selected in the **Source** tab
5. Click the **Pulse** button (Signal Type area).

6. Click **Select Meas > Pulse – Amplitude > Amplitude**.
7. Select **Meas 2**.
8. Click the **Source1** button.
9. Make sure the channel under test is selected in the **Source** tab
10. Click the **Pulse** button (Signal Type area).
11. Click **Select Meas > Pulse – Timing > RMS Jitter**. Dismiss any database notification messages that are displayed.
12. Verify that **Use Wfm Database** is selected (in the Source tab area); if not, select it.
13. Click the **Wfm Database** tab and select **Display** (in the Database area).

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**NOTE.** *The instrument will select whichever of the two databases that is not in use. Turn on Display Database for the database that shows the current channel in the Source box. Deselect Database On for the other database.*

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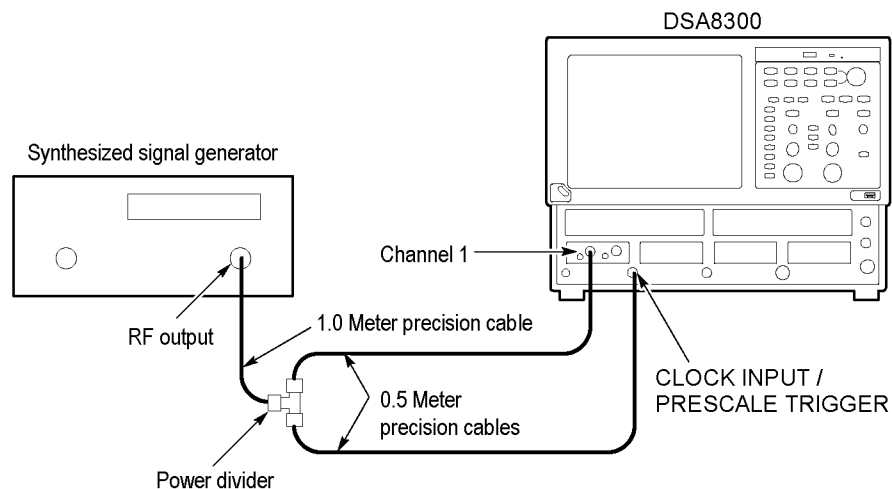
14. Set the Horizontal Scale to **2 ps/div** and position the rising edge until it goes through the center of the display graticule (where the center horizontal and vertical graticules cross).
15. Set the Vertical Scale to **5 mV/div**.
16. Click the **Acq** tab and set the following:
  - Stop After to **Condition**.
  - Number of Acquisitions to **400**.
17. Push the **CLEAR DATA** front-panel button, and then push the **RUN/STOP** button. The instrument takes 400 acquisitions and stops. This acquisition takes a couple of seconds. Note the value in the RMS Jitter measurement readout.
18. Repeat step to take several RMS Jitter readings and enter the average value on the Test Record for the module under test. Typical values are **200 fs or less**. This measurement does not have a guaranteed specification.
19. Move the signal source cable to the next module under test. Repeat from setup step for each 80E00 series modules installed. Check one input per module (for example, channels 1 and 3 if two modules are installed).
20. Disconnect the test setup unless you are proceeding to the next test.

*End of Procedure*

## External Clock/Prescale Trigger Delay Jitter

<b>Equipment required</b> (See Table 1-1.)	0.5 meter precision SMA cable (item 15)
	1.0 meter precision SMA cable (item 16)
	Power divider (item 26)
	Synthesized signal generator (item 31)
	Electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, and 80E10)
<b>Prerequisites</b>	As listed under <i>Prerequisites</i> . (See page 1-17, <i>Prerequisites</i> .)

### Setup



**Figure 1-12: External Clock/Prescale trigger delay jitter test setup**

1. Install the 80E0X module(s) to test into the left-most small module slots. Power on the instrument and wait 20 minutes for warm-up.
2. Connect the test equipment (See Figure 1-12.)

3. Set the synthesized signal generator as follows:
  - Frequency to **2.5 GHz**.
  - Output to **1.6 V<sub>p-p</sub>** (800 mV<sub>p-p</sub> displayed).
4. Set the DSA8300 as follows:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select the input channel of the module under test from the Waveform Selector menu (left end of controls bar at bottom of the graticule).
  - c. Select **Setup > Mode/Trigger** tab and set the following:
    - Trigger Source to **Clock**.
    - Click the **Eye** button (Scope Mode area).
  - d. Push the **Clear Data** front panel button.
  - e. Click the **Vert** tab and set the following:
    - Scale to **100 mV/div**.
    - Offset to **0**.
  - f. Click the **Horz** tab and set the following:
    - Scale to **200 ps/div**.
    - Horizontal Reference to **0%**.
    - Position to **20 ns** (set to **29 ns** for 80E07, 80E08, 80E09, and 80E10).

**Test** Follow this procedure to make the External Clock/Prescale Trigger Delay Jitter check:

1. Click the **Meas** tab.
2. Select **Meas 1**.
3. Click the **Source1** button.
4. Make sure the channel under test is selected in the **Source** tab
5. Click the **Pulse** button (Signal Type area).
6. Click **Select Meas > Pulse – Amplitude > Amplitude**.
7. Verify that **Use Wfm Database** is selected (in the Source tab area); if not, select it.
8. Select **Meas 2**.
9. Click the **Source1** button.
10. Make sure the channel under test is selected in the **Source** tab

11. Click the **Pulse** button (Signal Type area).
12. Click **Select Meas > Pulse – Timing > RMS Jitter**. Dismiss any database notification messages that are displayed.
13. Verify that **Use Wfm Database** is selected (in the Source tab area); if not, select it.
14. Click the **Wfm Database** tab and select **Display** (in the Database area).

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**NOTE.** *The instrument will select whichever of the two databases that is not in use. Turn on Display Database for the database that shows the current channel in the Source box. Deselect Database On for the other database.*

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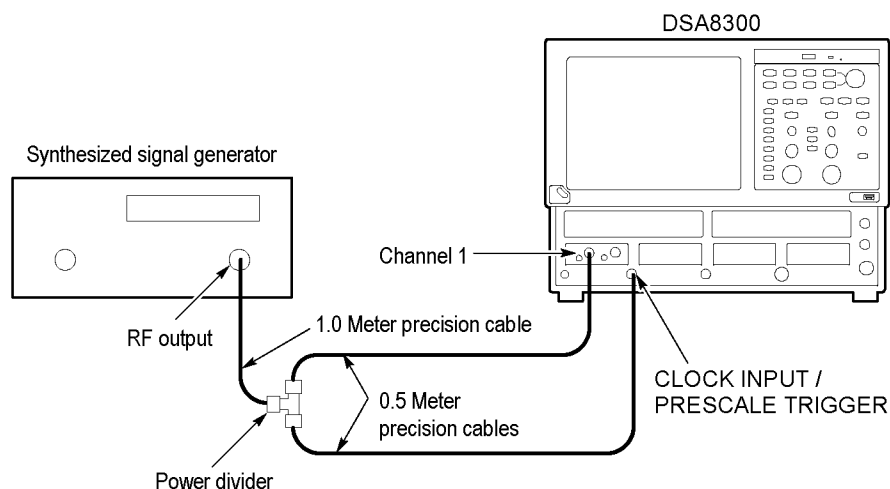
15. Adjust the synthesizer signal generator level until the amplitude measurement readout on the DSA8300 shows **800 mV**.
16. Click the **Horz** tab, set the Horizontal Scale to **20 ps/div**, and use the Horizontal POSITION knob to position the rising edge until it goes through the center of the display graticule (where the center horizontal and vertical graticules cross).
17. Click the **Vert** tab and set the Vertical Scale to **20 mV/div**.
18. Verify that the RMS Jitter read out on the instrument screen is less than **500 fs**.
19. Click the Mode/Trigger tab and set the Scope Mode to **Other**.
20. Reposition the zero crossing rising edge to the middle of the screen.
21. Verify that the RMS Jitter measurement readout value is less than **1.4 ps**.

*End of Procedure*

## External Clock/Prescale Trigger Sensitivity

<b>Equipment required</b> (See Table 1-1.)	0.5 meter precision SMA cable (item 15)
	1.0 meter precision SMA cable (item 16)
	Power divider (item 26)
	Synthesized signal generator (item 31)
	Electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, and 80E10)
<b>Prerequisites</b>	As listed under <i>Prerequisites</i> . (See page 1-17, <i>Prerequisites</i> .)

## Setup



**Figure 1-13: External prescaled trigger sensitivity test setup**

1. Install the 80E0X module(s) to test into the left-most small module slots. Power on the instrument and wait 20 minutes for warm-up.
2. Connect the test equipment (See Figure 1-13.)
3. Set the synthesized signal generator as follows:
  - Frequency to **2.0 GHz** (500 ps period).
  - Output to **400 mV<sub>p-p</sub>** (200 mV<sub>p-p</sub> displayed).
4. Set the DSA8300 as follows:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select the input channel of the module under test from the Waveform Selector menu (left end of controls bar at bottom of the graticule).
  - c. Select **Setup > Mode/Trigger** and set the following:
    - Trigger Source to **Clock**.
    - Click the **Eye** button (Scope Mode area).
  - d. Click the **Vert** tab and set the following:
    - Scale to **50 mV/div**.
    - Offset to **0**.
  - e. Click the **Horz** tab and set the following:
    - Scale to **200 ps/div**.
    - Horizontal Reference to **0%**.
    - Position to **20 ns** (set to **29 ns** for 80E07, 80E08, 80E09, and 80E10).

**Test** Follow this procedure to make the External Clock/Prescale Trigger Sensitivity check:

1. Click the **Meas** tab.
2. Select **Meas 1**.
3. Click the **Source1** button.
4. Make sure the channel under test is selected in the **Source** tab
5. Click the **Pulse** button (Signal Type area).
6. Click **Select Meas > Pulse – Amplitude > Amplitude**.
7. Select **Meas 2**.
8. Click the **Source1** button.
9. Make sure the channel under test is selected in the **Source** tab
10. Click the **Pulse** button (Signal Type area).
11. Click **Select Meas > Pulse – Timing > Frequency**.
12. Adjust the synthesizer signal generator frequency and level to the following values:

**External Clock/Prescale trigger sensitivity test: signal generator settings**

Frequency	Level (amplitude measurement readout on DSA8300)
2 GHz to 15 GHz in 1 GHz increments	200 mV
2 GHz to 15 GHz in 1 GHz increments	800 mV

13. Push the **Clear Data** front-panel button to reset the frequency change warning message.
14. Adjust the Horizontal **Scale** knob to display two complete waveform periods on the screen.
15. Verify that the DSA8300 Frequency readout value is within 10% of the true (input signal) value.
16. Repeat steps 12 through 15 for each frequency and level setting.
17. Disconnect the test setup.

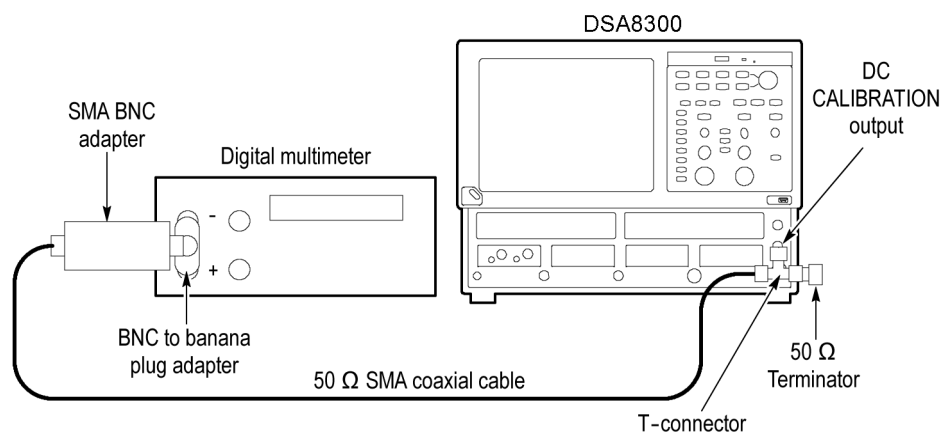
*End of Procedure*



## DC Calibration Output

<b>Equipment required</b> (See Table 1-1.)	SMA female to BNC male connectors (item 3)
	BNC to banana plug adapter 103-0090-00 (item 4)
	SMA "T" 1 male to 2 SMA female (item 5)
	50 $\Omega$ , 39.37 in (1.0 m), male-to-male SMA cables (item 16)
	Digital multimeter, such as the Keithley 2000-20 (item 18)
	Coaxial termination, 50 $\Omega$ 0.5 W, SMA male (item 39)
<b>Prerequisites</b>	Electrical sampling module (80E01, 80E02, 80E03, 80E04, 80E06, 80E07, 80E08, 80E09, and 80E10)

### Setup



**Figure 1-14: DC calibration output test setup**

1. Install an 80E0X module. Power on the instrument and wait 20 minutes for warm-up.
2. Connect the test equipment (See Figure 1-14.)
3. Push the front-panel **DEFAULT SETUP** button and click **Yes** in the confirmation dialog box.
4. Select **Setup > Mode/Trigger** and click **Direct** trigger mode.
5. Set the multimeter to read **DC volts**.

**Test** Follow this procedure to make the DC calibration output check:

1. Select **Setup >Vertical**.
2. Set the **DC Cal** parameter to each of the following settings and record the DMM readings in the test record.
  - +1.0 V
  - 0.0 V
  - -1.0 V
3. Check the readings against the limits in the test records.
4. Disconnect the test setup.

*End of Procedure*

*End of Main Instrument procedures*

# Electrical Sampling Modules

These procedures check those characteristics that relate to the electrical sampling modules and are listed and checked in the *DSA8300 Digital Serial Analyzer Specifications* manual.

---

**NOTE.** *The test hookups in the procedures illustrate an electrical module installed into a small compartment. The 80E07, 80E08, 80E09, and 80E10 Electrical Sampling Remote modules functionally operate the same as the non-remote modules, using a similar setup.*

---

## Prerequisites

Be sure you have performed the following prerequisites and the *Prerequisites* before doing any procedures in this section. (See page 1-17, *Prerequisites*.)

- Install the 80E0X modules in one of the small compartments in the instrument.
- Check 80E0X module push-buttons: Push the channel 1 and channel 2 buttons and observe that the yellow indicator lights turn on. Push them again and observe that the lights turn off. Note that there are two push-buttons per channel on the 80E07, 80E08, 80E09, and 80E10: one on the main module and one on the remote head. Check both of these.

---

**NOTE.** *Use a calibrated torque wrench when connecting the terminators, adapters, attenuator, and power sensor in this setup. Use  $8 \pm 0.3$  inch pounds of torque.*

---

---

**NOTE.** *When a procedure calls for the display of setup dialog boxes, you can display them from the Setup menu in the menu bar at the top of the screen. These procedures assume you will display and dismiss them as needed.*

---

---

**NOTE.** *The procedures throughout this chapter contain instructions based on the menus and controls from the most updated instrument software available at the time this document was released. These procedures will work for other versions of software, but some control and menu names may vary slightly.*

---

# Input Impedance

These procedures check those characteristics that relate to the signal acquisition and are listed as checked in the *DSA8300 Digital Serial Analyzer Specifications* manual.

<b>Equipment required</b> (See Table 1-1.)	Adapter, SMA female to BNC male connectors (item 3)
	Adapter, BNC to dual banana plugs (item 4)
	Cable, coaxial 50 $\Omega$ , 20 in (0.5 m), male-to-male SMA (item 15)
	Digital multimeter (item 18)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .)
	(See page 1-153, <i>Prerequisites</i> .)

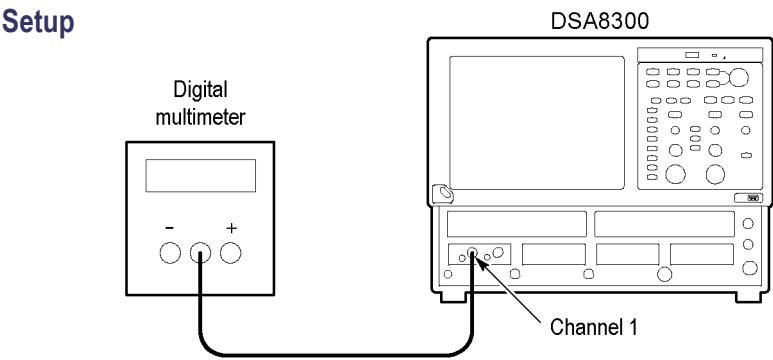


Figure 1-15: Input impedance test setup

1. Install the 80E0X module into the left-most small module slot of the instrument.
2. Connect the Digital multimeter to Channel 1 of the 80E0X module as shown in the figure.
3. Set the DSA8300 as follows:
  - a. Select **C1** from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
  - b. In the Mode/Trigger dialog box, select **TDR** (200 kHz).
  - c. In the Vert Setup dialog box, set the Channel Offset to **0.0 V**.
  - d. In the Horz Setup dialog box:
    - Set Scale to **2 ns/div**.
    - Set Position to **0** (this will automatically change to the minimum non-zero value).
    - Set Horizontal Reference to **0%**.
  - e. In the Acq Setup dialog box, set Acquisition Mode to **Sample**.

**Test** Follow this procedure to make the input impedance check:

1. Set the digital multimeter (DMM) to measure **Ohms**.
2. Record the resistance reading (*InputR*).
3. Swap the test leads at the DMM and again record the resistance reading (*reverseInputR*).
4. Check average of *InputR* and *reverse-InputR*:
 

■ 80E01, 80E02, 80E03, 80E04, 80E06:	$\leq 50.5 \Omega$ and $\geq 49.5 \Omega$
■ 80E07, 80E08, 80E09, 80E10:	$\leq 51 \Omega$ and $\geq 49 \Omega$
5. *80E04 Only*: Set the Digital multimeter to measure **Volts** at the minimum range ( $\leq 100 \text{ mV}$ ).
6. *80E04 Only*: Record reading on the Digital multimeter as baseline voltage.
7. *80E04 Only*: Check baseline voltage for  $\leq \pm 1 \text{ mV}$ . Enter value on test record.
8. Make the following settings, and then repeat steps 1 through 7 to check channel 2.
  - a. Select the next channel to test (if any) from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
  - b. In the Vert Setup dialog box, set Offset to **0.0 V**.
9. Disconnect the test setup.

*End of Procedure*

# DC Voltage Measurement Accuracy

These procedures check those characteristics that relate to the signal acquisition and are listed as checked in the *DSA8300 Digital Serial Analyzer Specifications* manual.

<b>Equipment required</b> (See Table 1-1.)	Adapter, SMA female to BNC male connectors (item 3)
	Adapter, BNC to dual banana plugs (item 4)
	SMA "T", male to 2 SMA female (item 5)
	Two 50 $\Omega$ , precision coaxial cables, SMA connectors (item 15)
	Digital Multimeter (item 18)
	DC Power Supply (item 19)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .)
	(See page 1-153, <i>Prerequisites</i> .)

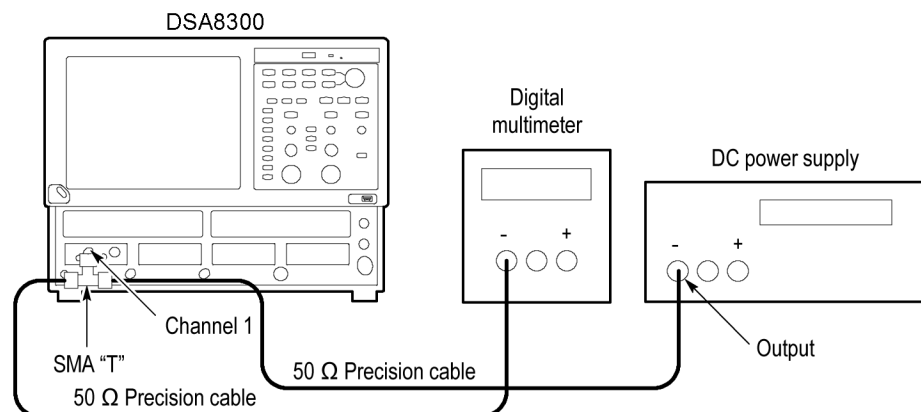


**WARNING.** *Improper operation of the DC Power Supply may create a shock hazard.*



**CAUTION.** *To avoid damage to the electrical module, do not exceed 2 volts input.*

## Setup



**Figure 1-16: Vertical DC accuracy test setup**

1. Perform instrument and module compensation. (See page 1-3, *Instrument and Module Compensation*.)
2. Set the output of a DC power supply to **off** or **0** volts.
3. Connect a SMA T to Channel 1 of the sampling module.

4. Connect a 50  $\Omega$  precision coaxial cable to one side of the SMA T. Connect a 50  $\Omega$  precision coaxial cable to the remaining side of the SMA T as shown in the following figure.
5. Connect one 50  $\Omega$  precision coaxial cable to the output of a DC power supply through a dual-banana connector. Connect the remaining 50  $\Omega$  precision coaxial cable to a digital multimeter as shown in the following figure.
6. Set up the main instrument as follows:
  - a. Select **C1** from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
  - b. In the Mode/Trigger dialog box, set Trigger Source to **TDR**.
  - c. In the Acq Setup dialog box:
    - Set Acquisition Mode to **Average** and **32 samples**.
    - Under Stop After, select the **Condition** box, and select **Average Complete** from the pull-down menu.
  - d. In the Horz Setup dialog box:
    - Set Scale to **2 ns/div**.
    - Set Position to **0** (this will automatically change to a minimum non-zero value).
    - Set Horizontal Reference to **0%**.
  - e. In the Meas Setup dialog box:
    - Select **Meas 1** and make sure the **Source1** button is selected.
    - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse - Amplitude > Mean**.
  - f. In the Vert Setup dialog box, set Scale to **100 mV/div**.

Table 1-2: DC voltage measurement accuracy

Module	DC power supply settings	Offset settings	Accuracy limits
80E01	-1550 mV	-1100 mV	$\pm 18.7$ mV
80E02	-1350 mV	-1100 mV	$\pm 14.7$ mV
80E03	-1100 mV	-1100 mV	$\pm 9.7$ mV
80E04	-850 mV	-1100 mV	$\pm 14.7$ mV
80E06	-650 mV	-1100 mV	$\pm 18.7$ mV
	-450 mV	0 mV	$\pm 11$ mV
	-250 mV	0 mV	$\pm 7$ mV
	0 mV	0 mV	$\pm 2$ mV

Table 1-2: DC voltage measurement accuracy (cont.)

Module	DC power supply settings	Offset settings	Accuracy limits
	+250 mV	0 mV	±7 mV
	+450 mV	0 mV	±11 mV
	+650 mV	+1100 mV	±18.7 mV
	+850 mV	+1100 mV	±14.7 mV
	+1100 mV	+1100 mV	±9.7 mV
	+1350 mV	+1100 mV	±14.7 mV
	+1550 mV	+1100 mV	±18.7 mV
80E07	-1050 mV	-600 mV	±15.2 mV
80E08	-850 mV	-600 mV	±11.2 mV
80E09	-600 mV	-600 mV	±6.2 mV
80E10	-350 mV	-600 mV	±11.2 mV
	-150 mV	-600 mV	±15.2 mV
	-450 mV	0 mV	±11 mV
	-250 mV	0 mV	±7 mV
	0 mV	0 mV	±2 mV
	+250 mV	0 mV	±7 mV
	+450 mV	0 mV	±11 mV
	+150 mV	+600 mV	±15.2 mV
	+350 mV	+600 mV	±11.2 mV
	+600 mV	+600 mV	±6.2 mV
	+850 mV	+600 mV	±11.2 mV
	+1050 mV	+600 mV	±15.2 mV

**Test** Follow this procedure to make the Vertical DC accuracy checks:

1. Set the DC supply voltage to the settings listed based on the module being tested. (See Table 1-2.)
2. Push the **CLEAR DATA** button on the front panel.
3. Push the **RUN/STOP** button on the front panel.
4. Record the input voltage reading on the digital multimeter.
5. Record the voltage for the Mean measurement displayed on the main instrument screen.
6. Calculate DC voltage accuracy:  $error = input\ V - mean\_meas\ V$ .



7. Verify that the error calculated in step 6 is within the limits listed in table for the associated vertical scale and offset and DC voltage settings. (See Table 1-2.) Enter the value on test record.
8. Repeat steps 1 through 7 until all DC voltage and offset settings, listed in the table, are checked for the channel under test. (See Table 1-2.)
9. Change all settings in the setup to Channel 2, and then repeat steps 1 through 7 until all DC voltage settings and offset settings are checked. (See Table 1-2.)

*End of Procedure*

**Test** Follow this procedure to make the DC vertical voltage accuracy, single point, compensated checks:

The gain of the 80E00 is equal to the slope of a regression line of the paired measurement readings in the following table, with the  $V_{in}$  values plotted along the x axis, and the measured values plotted along the Y axis.

Linear least squares fit algorithm:

$y = ax + b$ , where

$a = (nS_{xy} - S_x S_y) / (nS_{xx} - S_x^2)$

$b = (S_{xx} S_y - S_{xy} S_x) / (nS_{xx} - S_x^2)$

$x = \text{abscissa (controlled value)}$

$y = \text{ordinate (measured value)}$

$S_x = \text{Sum}(x)$

$S_{xx} = \text{Sum}(x^2)$

$S_{xy} = \text{Sum}(xy)$

$S_y = \text{Sum}(y)$

$n = \text{number of points}$

1. Set up the main instrument as follows:
  - a. Select **C1** from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
  - b. In the Acq Setup dialog box:
    - Set Acquisition Mode to **Average, 16 samples**.
  - c. In the Vert Setup dialog box:
    - Set Scale to **100 mV/div**.
    - Set Offset to **0 mV**.
  - d. In the Meas Setup dialog box:
    - Select **Meas 1** and make sure the **Source1** button is selected.
    - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Amplitude > Mean**.
2. Set the power supply ( $V_{in}$ ) = **–450 mV**.
3. Record the DVM measurement in the *Input  $V_{in}$*  and the  $x$  columns as shown in the following table.
4. Read mean measurement and record it in the *Measured  $V, mV$*  and  $y$  columns as shown in the following table.
5. Repeat steps 2 to 3 for all other  $V_{in}$ .
6. Calculate  $S_x$ ,  $S_{xx}$ ,  $S_y$ , and  $S_{xy}$ , for each setting:
  - a. Copy the *Input  $V_{in}$*  value to the  $x$  column.
  - b. Copy the *Measured  $V, mV$*  value to the  $y$  column.
  - c. Calculate  $x^2$  and record in the  $x^2$  column.
  - d. Calculate  $xy$  and record the value in the  $xy$  column.
  - e. Add the up the  $x$ ,  $x^2$ ,  $y$  and  $xy$  columns and record the sums in the  $S_x$ ,  $S_{xx}$ ,  $S_y$  and  $S_{xy}$  columns.
7. Calculate  $a$ ,  $b$ :
  - a.  $a = (nS_{xy} - S_x S_y) / (nS_{xx} - S_x^2)$
  - b.  $b = (S_{xx} S_y - S_{xy} S_x) / (nS_{xx} - S_x^2)$
8. Calculate  $y = ax + b$  for all  $x$ .
9. Calculate the deviation of *Measured  $V - Y$*  for all  $x$ .

Table 1-3: Data for calculation of gain and linearity

$V_{in}$ mV	Input $V_{in}$	Measured V, mV	x	$x^2$	y	xy	$Y = ax+b$	Deviation	lower limit	upper limit
-450									-10	+10
-350									-10	+10
-250									-10	+10
-150									-10	+10
-50									-10	+10
50									-10	+10
150									-10	+10
250									-10	+10
350									-10	+10
450									-10	+10
									-10	+10
n			$S_x$	$S_{xx}$	$S_y$	$S_{xy}$				

10. Change all settings in the setup to Channel 2, and then repeat steps 1 through 9 until all DC vertical voltage accuracy, single point, compensated calculations listed in the table are checked. (See Table 1-3.)

11. Disconnect the test setup.

*End of Procedure*

## Random Noise, Displayed

These procedures check those characteristics that relate to the signal acquisition and are listed as checked in the *DSA8300 Digital Serial Analyzer Specifications* manual.

<b>Equipment required</b>	No external equipment required
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .) (See page 1-153, <i>Prerequisites</i> .)

**Setup**

No test equipment hook up is required.

1. Set up the main instrument as follows:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select **C1** from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
  - c. In the Mode/Trigger dialog box, set Trigger Source to **TDR** (200 kHz).
  - d. In the Acq Setup dialog box:
    - Set Acquisition Mode to **Sample**.
    - Under Stop After, click Condition and select **Number of Acquisitions** from the pull down menu. Enter **96** for the number of acquisitions.
  - e. In the Horz Setup dialog box:
    - Set Record length to **1000 points**.
    - Set Scale to **1 ps/div**.
    - Set Position to **0** (this will automatically change to the minimum non-zero value).
    - Set Horizontal Reference to **0%**.
  - f. In the Vert Setup dialog box:
    - Set Scale to **2 mV/div** if testing with an 80E01 or 80E06 module; set to **1 mV/div** for all other modules.
    - Set Offset to **0 mV**.
    - Set Bandwidth to the maximum setting (module dependant).

**Test**

Follow this procedure to make the Random noise checks:

1. In the Wfm Database Setup dialog box, click **Display** and set Source to **C1 on Main**.
2. In the Hist Setup dialog box, click **Enable Histogram** and **Vertical** in the Source area.
3. Adjust the right and left side histogram window to the contain all the horizontal divisions.
4. Position the top histogram window three major divisions above the center line.
5. Position the bottom histogram window three major divisions below the center line.
6. Push the **CLEAR DATA** button on the front panel.
7. Push the **RUN/STOP** button on the front panel.

8. Record the noise (V STD DEV) reading.
9. Check noise V for the module tested in the following table.

**Table 1-4: Random noise limits**

Module	Bandwidth setting	Noise limit
80E01		≤2.3 mV
80E02		≤800 μV
80E03, 80E04		≤1.2 mV
80E06		≤2.4 mV
80E07, 80E08	30 GHz BW setting	≤410 μV
	20 GHz BW setting	≤380 μV
80E09	60 GHz BW setting	≤600 μV
	40 GHz BW setting	≤480 μV
	30 GHz BW setting	≤410 μV
80E10	50 GHz BW setting	≤700 μV
	40 GHz BW setting	≤480 μV
	30 GHz BW setting	≤410 μV

10. Repeat steps 1 through 8 for each bandwidth setting.
11. Repeat steps 1 through 8 for channel 2.

*End of Procedure*

## Analog Bandwidth up to 50 GHz (80E01, 80E06, 80E07, 80E08, 80E09, 80E10)

These procedures check those characteristics that relate to the signal acquisition and are listed as checked in the *DSA8300 Digital Serial Analyzer Specifications* manual. This check has two procedures that characterizes the reference signals. The last procedure characterizes the sampling module.

**NOTE.** *This test setup is limited to 50 GHz. To test modules with a bandwidth above this, you will also need to perform the Analog Bandwidth to 60 GHz procedure.*

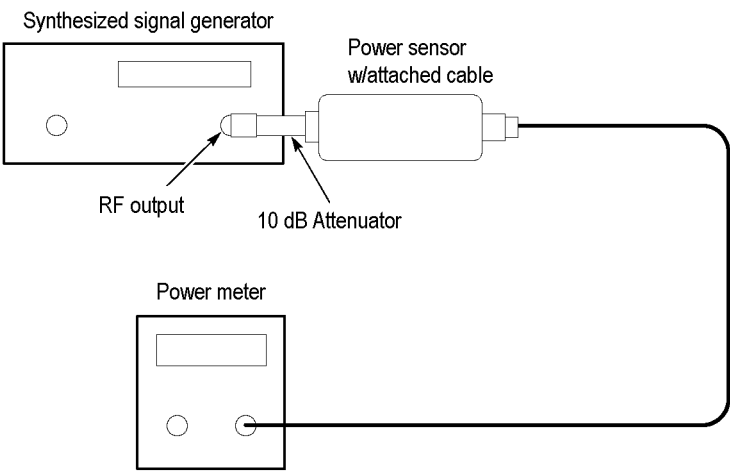
<b>Equipment required</b> (See Table 1-1.)	Adapter, 2.4 mm male-to-male (item 1)
	Adapter, 2.4 mm female-to-female (item 2)
	Attenuator, 10 dB pad, SMA, Femal to Male (item 6)
	Cable, special, power/phase stability (item 14)
	Power meter (item 24)
	Power sensor (item 25)
	Synthesized signal generator (item 31)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .)
	(See page 1-153, <i>Prerequisites</i> .)

**Power-Reference  
Characterization Setup**

Install the test setup to measure the power reference:

**NOTE.** Use a torque wrench when connecting the terminators, adapters, attenuator, and power sensor in this setup. Use  $8 \pm 0.3$  inch pounds of torque.

1. Connect the 10 dB attenuator to the Synthesized signal generator. Connect the remaining end to the power sensor. Connect the power sensor to the power meter.



**Figure 1-17: Power-reference setup**

**Reference  
Characterization  
Measurements**

Follow this procedure to characterize the reference signals:

1. Set the Synthesized signal generator to 0 dBm.
2. Set the signal frequency and the power meter frequency to each of the frequencies listed in the *Frequency* column of the following table.

Table 1-5: Power reference

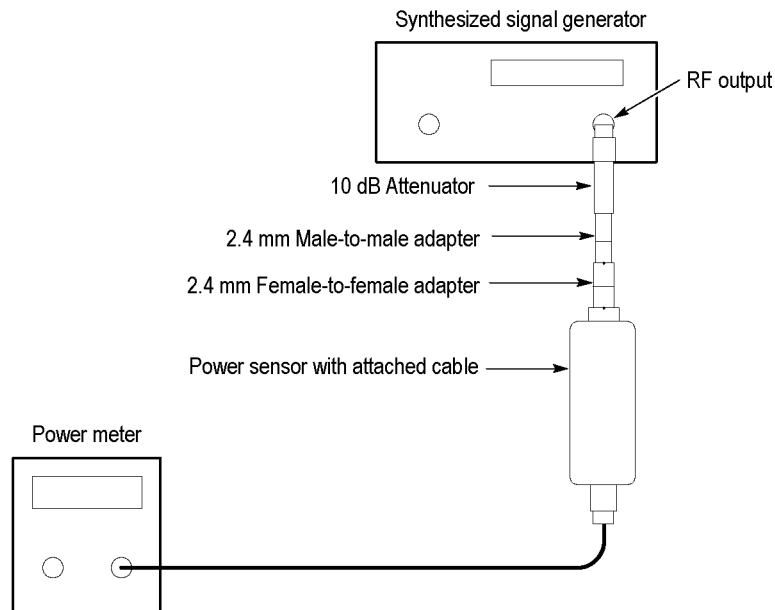
Frequency <sup>1</sup>	Reference Level dBm	Reference level with adapters dBm	2.4 mm female to female adapter loss dB
50 MHz			
4 GHz			
8 GHz			
12 GHz			
16 GHz			
20 GHz			
24 GHz			
28 GHz			
30 GHz			
32 GHz			
36 GHz			
40 GHz			
44 GHz			
48 GHz			
50 GHz			

3. Record the readings on the power meter in the *Reference Level dBm* column.

<sup>1</sup> You only need to characterize the frequency up to the maximum bandwidth of the module under test.

## Adapter-Characterization Setup

Install the test setup to characterize the adapter:



**Figure 1-18: Adapter characterization setup**

1. Connect the 10 dB attenuator to the Synthesized signal generator. Connect the other end of the cable to the 10 dB attenuator.
2. Connect the other end of the 10 dB attenuator to a 2.4 mm female-to-female adapter.
3. Connect the other end of the 2.4 mm female-to-female adapter to the power sensor.
4. Connect the other end of the power sensor to the power meter.

## Adapter Characterization Measurements

Follow this procedure to characterize the reference level with the adapters:

1. Set the signal frequency and the power meter frequency to each of the frequencies listed in the *Frequency* column of the table. (See Table 1-5.)

---

**NOTE.** You only need to characterize the reference level up to the maximum bandwidth of the module under test.

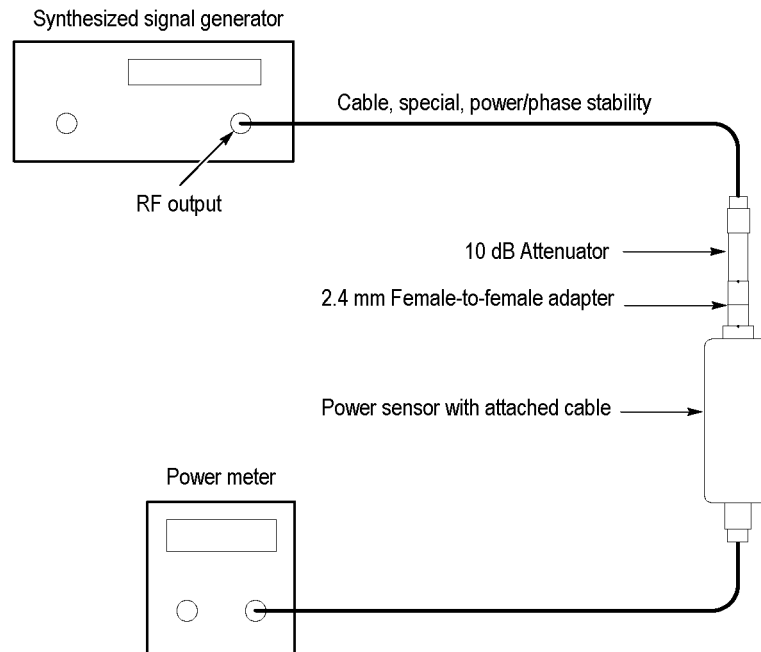
---

2. Record the readings on the power meter in the *Reference level with the adapters dBm* column of the table. (See Table 1-5.)
3. Calculate and record the *2.4 mm female-to-female adapter loss dB* in the table for all frequencies listed as follows (See Table 1-5.):

$$((\text{Reference level with adapters dBm}) - (\text{Reference level dBm})) / 2$$



**Setup** Install the test setup to measure reference signals:



**Figure 1-19: Measure reference signals**

**NOTE.** Use a torque wrench while connecting the adapters, power sensor in this setup. Use  $8 \pm 0.3$  inch pounds of torque.

1. Connect the cable to the Synthesized signal generator. Connect the remaining end of the cable to the 10 dB attenuator.
2. Connect the other end of the 10 dB attenuator to a 2.4 mm female-to-female adapter.
3. Connect the other end of the 2.4 mm female-to-female adapter to the power sensor.
4. Connect the power sensor to the power meter.
5. Set the synthesized signal generator to **+3 dBm**.
6. Set the signal frequency and the power meter frequency to each of the frequencies listed in the *Frequency* column of the following table.

**NOTE.** Only perform checks up to the maximum bandwidth of the module under test.

7. Adjust the RF signal level until the reading on the power meter is as close to **−9 dBm** as possible.
8. Record the Synthesized signal generator set level reading in the *Rfrnce RF set level dBm* column of the following table.
9. Record the Power meter reading in the *Measured RF level dBm* column of the following table.
10. Calculate and record the *Rfrnce RF level* in the following table for all frequencies listed as follows (See Table 1-5.):

$$Rfrnce\ RF\ level = (Measured\ RF\ level) - (2.4mm\ female\text{-}to\text{-}female\ adapter\ loss\ dB)$$

**Table 1-6: DUT (device under test) reference response (80E01, 80E06, 80E07) <sup>1</sup>**

Frequency				Rfrnce set level dBm	Measured RF level dBm	Rfrnce RF level	Measured level			DUT resp	
							80E01	80E06	80E07		
									20		30
50 MHz											
4 GHz											
8 GHz											
12 GHz											
16 GHz											
20 GHz											
24 GHz											
28 GHz											
30 GHz											
32 GHz											
36 GHz											
40 GHz											
44 GHz											
48 GHz											
50 GHz											

<sup>1</sup> Only perform checks up to the maximum bandwidth of the module under test.

Table 1-7: DUT (device under test) reference response (80E08, 80E09, 80E10) <sup>1</sup>

Frequency				Measured level									DUT resp
				80E08		80E09			80E10				
				20	30	30	40	60	30	40	50		
Rfrnce set level dBm	Measured RF level dBm	Rfrnce RF level											
50 MHz													
4 GHz													
8 GHz													
12 GHz													
16 GHz													
20 GHz													
24 GHz													
28 GHz													
30 GHz													
32 GHz													
36 GHz													
40 GHz													
44 GHz													
48 GHz													
50 GHz													

<sup>1</sup> Only perform checks up to the maximum bandwidth of the module under test.

## Setup

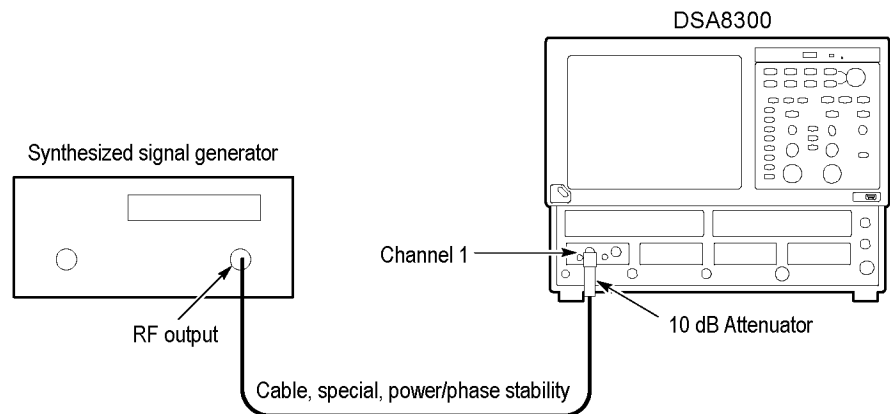


Figure 1-20: Reference signals setup

1. Install the module into the left-most small module compartment of the main instrument.
2. Connect one end of the cable to the Synthesized signal generator. Connect the other end of the cable to the 10 dB attenuator.

3. Connect the cable with the 10 dB attenuator to the sampling module input.

---

**NOTE.** Use a torque wrench while connecting the adapters, power sensor in this setup. Use  $8 \pm 0.3$  inch pounds of torque.

---

4. Set up the DSA8300:
  - a. Push the **Default Setup** front-panel button and click **Yes**.
  - b. Select **C1** from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
  - c. In the Mode/Trigger dialog box set Source to **TDR** (200 kHz).
  - d. In the Acq Setup dialog box, set the Acquisition Mode to **Envelope**.
  - e. In the Horz Setup dialog box:
    - Set Record Length to **2000 points**.
    - Set Position to **0** (this will automatically change to a minimum non-zero value).
    - Set Horizontal Reference to **0%**.
  - f. In the Vert Setup dialog box:
    - Set Scale to **35 mV/div**.
    - Set Offset to **0**.

**Test** Follow this procedure for the sampling module reference signals:

1. In the Meas Setup dialog box:
  - a. Select **Meas 1** and make sure the **Source1** button is selected.
  - b. Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Amplitude > Amplitude**.
2. Set the RF signal frequency listed in the *Frequency* column of the table. (See Table 1-7.)
3. Set the RF signal level listed in the *Reference Set Level dBm* column of the table. (See Table 1-7.)
4. In the Horz Setup dialog box, set the main instrument Horizontal Scale to  $(1/\text{Frequency})$ , where Frequency is the RF signal frequency.
5. Push the **CLEAR DATA** front panel button.
6. Push the **RUN/STOP** front panel button.

7. Record amplitude reading readout and use the value as AMPLITUDE (Volts) in the step that follows.
8. Convert Volts to dBm as follows:
 
$$V_p = (\text{AMPLITUDE}/2)$$

$$V_{RMS} = V_p / \text{SQRT}(2)$$

$$P1 = V_{RMS} * V_{RMS} / 50$$

$$\text{dBm} = 10 * \log(P1/0.001)$$
9. Record dBm in the *Measured level* column of the table. (See Table 1-7.)
10. Repeat steps 2 through 9 for all frequencies listed in the *Frequency* column of the table. (See Table 1-7.)
11. Calculate the DUT response as the difference between the *Measured level* column and the *Reference RF level* column in the table (See Table 1-7.) as:
 
$$(\text{Measured level}) - (\text{Reference RF level})$$
 Record the calculation results in the *DUT Response* column of the table. (See Table 1-7.)
12. Calculate all frequencies listed in the *Frequency* column of the table. (See Table 1-7.)
13. Find the maximum and minimum power points in the *DUT Response* column of the table. (See Table 1-7.)
14. The maximum power minus the power at 50 MHz should be less than +3.0 dB. The minimum power minus the power at 50 MHz should be greater than -3.0 dB. The specification is  $\pm 3.0$  dB referenced to 50 MHz.
15. Repeat the Setup and Test sections for all bandwidth settings that are valid for the module under test.
16. Repeat the Setup and Test sections for channel 2.
17. Disconnect the test setup.

*End of Procedure*

## Analog Bandwidth above 50 GHz (80E06 and 80E09)

These procedures check those characteristics that relate to the signal acquisition and are listed as checked in the *DSA8300 Digital Serial Analyzer Specifications* manual.

This procedure checks the upper bandwidth of the 80E06 and 80E09 modules.

---

**NOTE.** *This procedure checks tests the >50 GHz to 65 GHz frequencies. The procedure Analog Bandwidth to 50 GHz checks the lower bandwidths. (See page 1-163, Analog Bandwidth up to 50 GHz (80E01, 80E06, 80E07, 80E08, 80E09, 80E10).)*

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<b>Equipment required</b> (See Table 1-1.)	BNC to banana adapter (item 4)
	Cable, special, power/phase stability (item 14)
	Cable, coaxial, SMA (item 15)
	Cable, BNC (item 17)
	Scalar network analyzer (SNA) (item 42)
	Reflectometer, with OML DC power cable to dual banana plug (item 44)
	Power meter (item 45)
	Waveguide power sensor (item 46)
	Adapter, Wave Guide-to-1.85 mm male (item 51)
	Adapter, Wave Guide-to-1.85 mm female (item 52)
	Waveguide section (item 53)
	80N01 Module Extender (item 55)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .)
	(See page 1-153, <i>Prerequisites</i> .)
	You must have performed the procedure <i>Analog Bandwidth to 50 GHz</i> . (See page 1-163, <i>Analog Bandwidth up to 50 GHz</i> (80E01, 80E06, 80E07, 80E08, 80E09, 80E10).)

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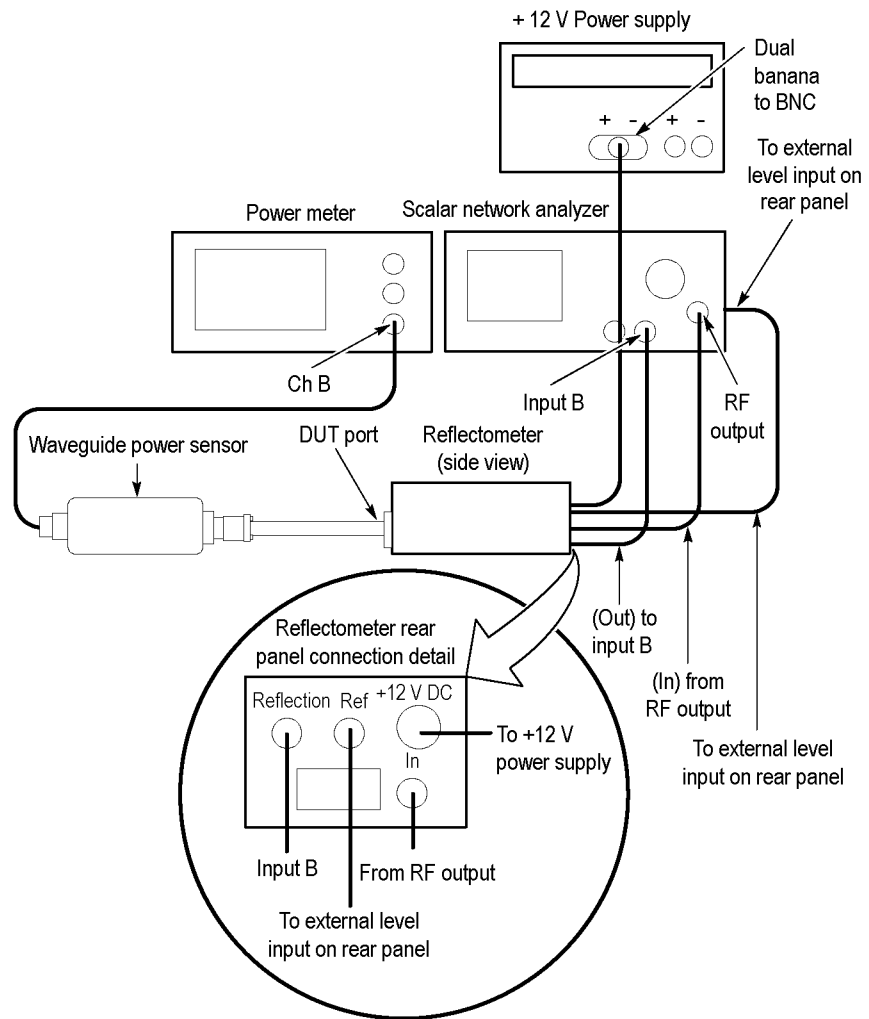
### SNA & Reflectometer Characterization

Do the following steps to store reflected reference levels in the SNA:

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**NOTE.** *Use a torque wrench when connecting the terminators, adapters, attenuator, and power sensor in this setup. Use  $8 \pm 0.3$  inch pounds of torque.*

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**Figure 1-21: Setup to measure Power-in**

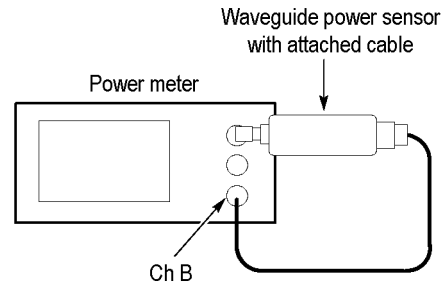
1. Refer to the following figure as you perform the following steps:
  - a. Connect the output of a +12 V power supply to the dual-banana plug end of the OLM DC power cable.
  - b. Connect the remaining end of the OLM DC power cable to the +12 V input of the Reflectometer.
  - c. Connect the RF output of the SNA to a Wave Guide-to-1.85 mm female adapter. Connect a 50  $\Omega$ , cable from the adapter to the RF input of the Reflectometer.
  - d. Connect the Reflection output of the Reflectometer to Input B of the SNA through an Aritsu 560-10BX-2 cable.
  - e. Connect the Ref output of the Reflectometer to External Level input of the SNA the through a 50  $\Omega$ , BNC cable.
  - f. Connect one end of a Waveguide section to the DUT port of the Reflectometer.
  - g. Connect the Waveguide short directly to the remaining end of the Waveguide.
2. Set the SNA as follows:
  - Output level: **+9 dBm**
  - Frequency Multiplier: **4**
  - Frequency Span: **50 GHz to 65 GHz**
  - No. of Averages: **8**
  - Leveling: **External**
  - Channel 1: **Off**
  - Channel 2: **Input B**
  - Channel 2 Meas/ Mode: **Return Loss**
3. Push the Calibration key to start calibrating the SNA to the Reflectometer.
4. Follow the instructions on the SNA screen to complete the calibration, with the following exception: leave the Waveguide short connected to the Waveguide section throughout calibration. Ignore the instruction on screen to connect a Waveguide open.
5. Save the Cal/Setup in Memory Location 2.
6. Leave the test equipment hooked up for use in later steps. You will use it when you do the steps under *Measure the Power In*.



### Power-Meter/Power Sensor Zero/Cal

Follow this procedure to zero and calibrate the Waveguide power sensor to the Power meter:

1. Connect the Waveguide power sensor to the Power Ref output of the Power meter as shown in the following figure.
2. Connect the attached cable end of the Waveguide power sensor to the channel input of the Power meter as shown in the following figure.
3. Zero and Cal the Power meter to the Waveguide power sensor.



**Figure 1-22: Power-reference characterization setup**

### Measure the Power In

Follow this procedure to measure the power in of each SNA reference signal at each frequency.

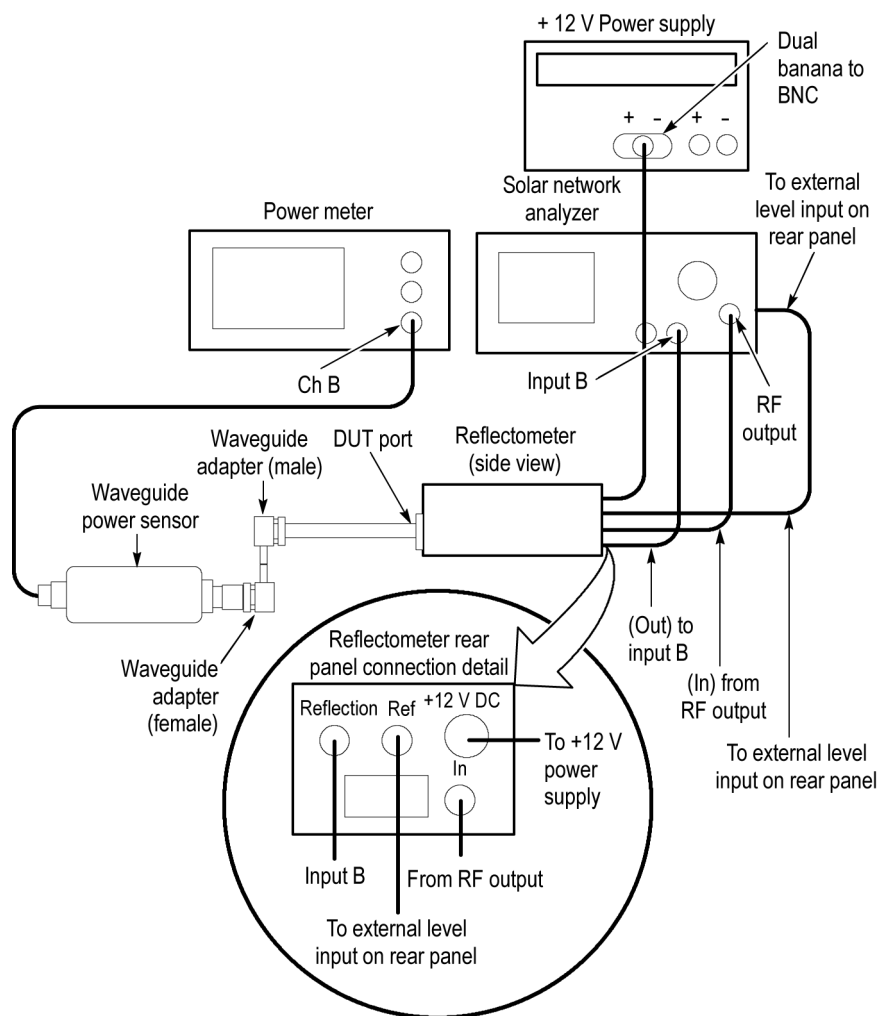
1. Refer to the above figure as you perform the following substeps:
  - a. Start with the test setup as was left from step 6.
  - b. Remove the Waveguide short from the Waveguide section.
  - c. Connect the Waveguide power sensor directly to the Waveguide section.
  - d. Connect the attached cable of the Waveguide power sensor to the **Ch B** input of the Power meter.
2. On the SNA, recall the Setup/Cal from Memory Location 2.
3. Set the SNA Frequency Span to **0 Hz** to set the SNA to single frequency mode.

4. Perform the following substeps:
  - a. Set the SNA signal frequency and the Power meter frequency to each of the frequencies listed in the *Frequency* column of the table. (See Table 1-8.)
  - b. In the Horz Setup dialog box, set the main instrument Horizontal Scale to  $(1/\text{Frequency})$ , where Frequency is the RF signal frequency.
  - c. Turn Trace Hold on the SNA to **On**.
  - d. Record the reading on the power meter in the *Reference Level* column.
  - e. Turn Trace Hold on the SNA to **Off**.
5. Leave the test equipment hooked up for use in the steps under *Adapter Characterization*.

### Adapter Characterization

Do the following procedure to derive the power loss of the adapters:

1. Refer to the following figure as you perform the following substeps:
  - a. Start with the test setup as left from step 5 in the last procedure.
  - b. Disconnect the Waveguide power sensor from the Waveguide section.
  - c. Connect the 1.85 mm end of a Waveguide-to-1.85 mm female adapter to the 1.85 mm end of a Waveguide-to-1, 85 mm male adapter.
  - d. Install the set of combined adapters between the Waveguide power sensor and the Waveguide section as is shown in the following figure.



**Figure 1-23: Adapter-loss setup**

2. Perform the following substeps:
  - a. Set the signal frequency and the power meter frequency to each of the frequencies listed in the *Frequency* column of the table. (See Table 1-8.)

**NOTE.** Only perform checks up to the maximum bandwidth of the module under test.

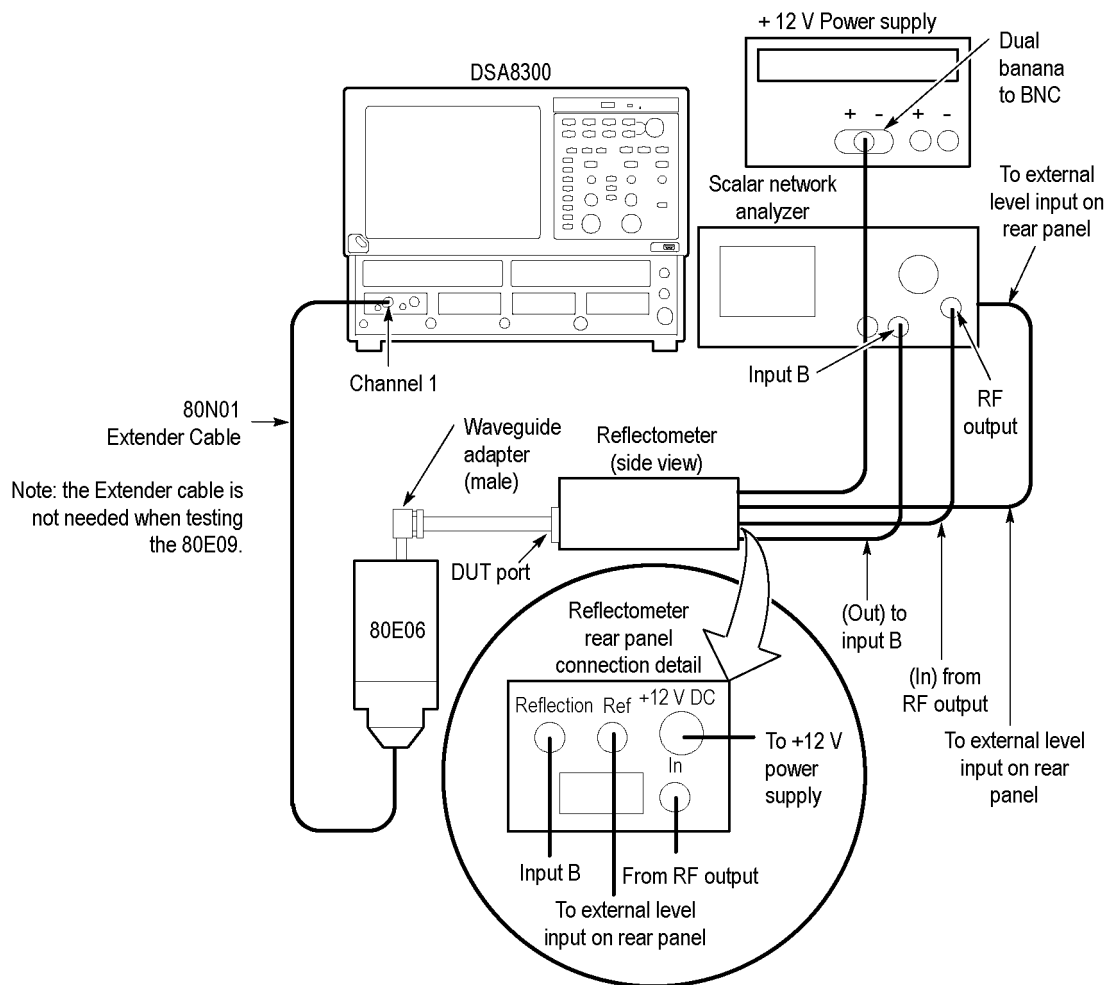
- b. Turn Trace Hold on the SNA to **On**.
  - c. Read the power loss from the SNA screen, and record it for each frequency in the *Adapter Loss* column of the table. (See Table 1-8.)
  - d. Turn Trace Hold on the SNA to **Off**.
3. Disconnect the Waveguide adapters (separating them from each other), the Waveguide power sensor, and the Power meter from the test setup. Leave the remainder of the test setup intact for use in the next procedure.

## HF Setup and Test

Do the following procedure to set up and test the HF Response.

**NOTE.** Use a torque wrench when connecting the terminators, adapters, attenuator, and Waveguide power sensor in this setup. Use  $8 \pm 0.3$  inch pounds of torque.

- 1.** Refer to the following figure as you perform the following substeps:
  - a.** Start with the remainder of the test setup from step 3 in the last procedure.
  - b.** If testing an 80E06, install the 80N01 Extender Cable in the leftmost slot of the main instrument and connect the cable end of the Extender to the 80E06. If testing an 80E09, install the module in the leftmost slot.
  - c.** Connect the one end of a Waveguide-to-1.85 mm male adapter to the input channel of the module to be tested. Connect the other end to the Waveguide section.



**Figure 1-24: HF response setup**

2. Set up the main instrument as follows:
  - a. Push the **DEFAULT SETUP** front-panel button and click **Yes**.
  - b. Select **C1** from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
  - c. In the Mode/Trigger dialog box, set Source to **TDR (200 kHz)**.
  - d. In the Acq Setup dialog box:
    - Set Acquisition Mode to **Envelope**.
    - Under Stop After, check **Condition** and select **Number of Acquisitions** from the pull down menu.
    - Set the Number of Acquisitions count to **64**.
  - e. In the Horz Setup dialog box:

- Set set scale to **100 ps/div**.
- Set Record Length to **1000 points**.
- Set Position to **0** (this will automatically change to a minimum non-zero value).
- Set Horizontal Reference to **0%**.
- f. In the Vert Setup dialog box:
  - Set Scale to **100 mV/div** (default).
  - Set Offset to **0 mV** (default).
- g. In the Measurements Setup dialog box:
  - Select **Meas1**.
  - In the Source tab, select Main **C1**.
  - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Amplitude > Amplitude**.
- 3. On the SNA, recall the Setup/Cal from Memory Location **2**.
- 4. Set the SNA Frequency Span to **0 Hz** to set the SNA to single frequency mode.
- 5. Perform the following substeps:
  - a. Set the SNA signal frequency to the first of the frequencies listed in the *Frequency* column of the table. (See Table 1-8.)
  - b. Turn Trace Hold on the SNA to **On**.
  - c. Push the **CLEAR DATA** front panel button on the main instrument.
  - d. Push the **RUN/STOP** front panel button.
  - e. Record amplitude reading readout and use the value as **AMPLITUDE** (Volts) in the substep g. that follows.
  - f. Convert Volts to dBm as follows:
$$V_p = (AMPLITUDE/2)$$
$$V_{RMS} = V_p / \sqrt{2}$$
$$P1 = V_{RMS}^2 / 50$$
$$dBm = 10 * \log(P1/0.001)$$
  - g. Record dBm in the *Measured level* column of the following table.
  - h. Turn Trace Hold on the SNA to **Off**.

6. Perform the following substeps for all frequencies listed in the *Frequency* column of the following table:
  - a. Calculate the Adapter Loss as the difference between the *Reference level (with adapters)* column and the *Reference level (no adapters)* column in the following table:
 
$$\text{Adapter Loss} = (\text{Ref level with adapters}) - (\text{Ref level no adapters})$$
  - b. Record the calculation results in the *Adapter Loss* column of the following table.
  - c. Calculate the module response using the values in the *Measured level* column and the *Reference level* column in the following table as:
 
$$\text{Module Response} = (\text{Measured level}) - (\text{Ref level with no adapters} + \text{Adapter Loss}/2)$$

$$\text{Module Response} = (\text{Measured level}) - (\text{Ref level with adapters} + \text{Adapter Loss}/2)$$
  - d. Record the calculation results in the *Response* column in the following table.
7. Find the maximum and minimum power points between the 50 MHz and 65 GHz points in the *Response* column as shown in the following table.

Table 1-8: Bandwidth response (55 GHz - 65 GHz)

Frequency <sup>1</sup>	Reference level (no adapters)	Reference level (with adapters)	Adapter loss	Measured level	80E06 response	80E09 response		
						30	40	60
55 GHz								
60 GHz								
65 GHz								

<sup>1</sup> Only perform checks up to the maximum bandwidth of the module under test.

8. Note the power at 50 MHz calculated as the module response recorded in the table of the procedure *Analog Bandwidth to 50 GHz*. (See Table 1-7.) You will use the 50 MHz power in the next step.
9. Find the maximum power and minimum power in the *Response* column of the table. (See Table 1-8.) Check that the following statements are true (the specification is  $\pm 3.0$  dB referenced to the 50 MHz):
  - The maximum power minus the 50 MHz power is less than +3.0 dB.
  - The minimum power minus the 50 MHz power is greater than –3.0 dB.
10. Repeat the Setup and Test sections for all bandwidth settings.

11. Repeat the Setup and Test sections for channel 2.

12. Disconnect the test setup.

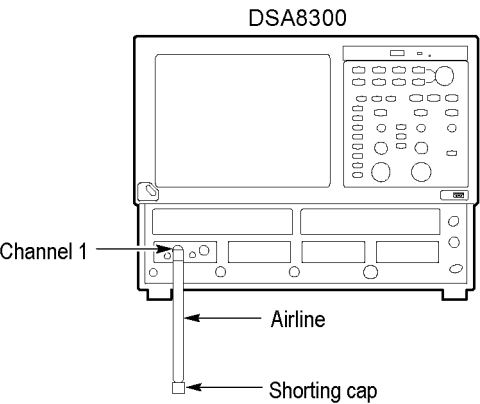
*End of Procedure*

## TDR-System Reflected Rise Time (80E04, 80E08, 80E10)

These procedures check those characteristics that relate to the TDR system and are listed as checked in the *DSA8300 Digital Serial Analyzer Specifications* manual.

<b>Equipment required</b> (See Table 1-1.)	3.5 mm airline, 80E04 and 80E08 only (item 9)
	2.4 mm airline, 80E10 only (item 10)
	Short, coaxial, 80E04 and 80E08 only (item 27)
	Short, 80E10 only (item 49)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .)
	(See page 1-153, <i>Prerequisites</i> .)

- Setup**
1. Connect a coaxial short to the female connector of the airline as shown in the following figure.
  2. Connect the airline to channel 1 of the module.



**Figure 1-25: TDR reflected rise time setup**



3. Push the **DEFAULT SETUP** front-panel button and click **Yes**.
4. Set up the main instrument as follows:
  - a. In the TDR Setup dialog box, click Preset **C1**.
  - b. There should be a positive pulse, about 1 ns long for a 10 cm airline. The reflection from the short is located at the falling edge of the pulse. This is the edge to be measured. Adjust the horizontal position knob to bring the falling edge to the center vertical graticule.
  - c. In the Horz Setup dialog box:
    - Set Record Length to **2000 points**.
    - Set Horizontal Reference to **50%**.
    - Set Scale to **50 ps/div**, while using the horizontal position knob to keep the falling edge centered.
  - d. In the Acq Setup dialog box:
    - Set Acquisition Mode to **Average, 128 samples**.
    - Under Stop After, check **Condition** and select **Average Complete** from the pull down menu.
  - e. In the Meas Setup dialog box:
    - Select **Meas 1** and make sure **Source1** button is selected.
    - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Timing > Fall Time**.

**Test** Follow this procedure to make the fall time checks:

1. Push the **CLEAR DATA** front panel button.
2. Push the **RUN/STOP** front panel button.
3. Check that the measured fall time (reflected rise time) for the positive edge polarity is as follows:
  - 80E04: **≤35 ps**
  - 80E08: **≤22 ps**
  - 80E10: **≤16 ps**
4. In the TDR Setup dialog box change C1 polarity to **negative edge** (pictured as a falling slope).

---

**NOTE.** *Since this display is in units of rho, the waveform will not invert when the edge polarity is changed, so the waveform will not appear to change significantly.*

---

5. Push the **CLEAR DATA** front panel button.
6. Push the **RUN/STOP** front panel button.
7. Check that the measured fall time (reflected rise time) for the negative edge polarity is as follows:
  - 80E04:  **$\leq 35$  ps**
  - 80E08:  **$\leq 22$  ps**
  - 80E10:  **$\leq 16$  ps**
8. Repeat the Setup and Test sections for channel 2.
9. Disconnect the test setup.

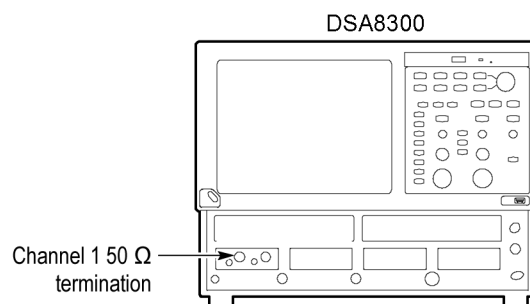
*End of Procedure*

## TDR-System Step Response Aberrations (80E04)

These procedures check those characteristics that relate to the TDR system and are listed as checked in the *DSA8300 Digital Serial Analyzer Specifications* manual.

<b>Equipment required</b> (See Table 1-1.)	Terminator, 50 $\Omega$ coaxial terminator, K male (item 28)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .) (See page 1-153, <i>Prerequisites</i> .)

### Setup



**Figure 1-26: TDR system step response aberrations setup**

1. Install the module into the left small module compartment of the main instrument.
2. Connect a 50  $\Omega$  coaxial terminator to channel 1 as shown in the following figure.

3. Push the **DEFAULT SETUP** front-panel button and click **Yes**.
4. Set up the main instrument as follows:
  - a. In the TDR Setup dialog box, click **C1 Preset**. This sets up Channel 1 (C1) positive polarity by default; it will later be manually switched to select negative polarity and for channel 2, during the test sequence.
  - b. In the Acq Setup dialog box set the Acquisition Mode to **Average**, **128** samples.
  - c. In the Horz Setup dialog box:
    - Set Record Length to **2000 points**.
    - Set Position to **1  $\mu$ s**.
    - Set Scale to **100 ns/div**.
  - d. In the Meas Setup dialog box:
    - Select **Meas 1** and make sure the **Source1** button is selected.
    - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Amplitude > Mean**.
  - e. Record for later use the High measurement value in mr, making sure to take down the proper sign. This will be used as HiRef, the high reference level for aberration measurements.

**Test** Follow this procedure to make the aberration checks:

1. Check aberrations in the range of 10 ns to 20 ps before the edge (aberrations within  $\pm 3\%$ ).
  - a. Set the Horizontal Position to **0** (or to the minimum value possible).
  - b. Change the Horizontal Scale to **50 ps/div** while adjusting Horizontal Position to keep the rising edge of the first step waveform on screen.
  - c. Push the front panel **FINE** button to turn it on.
  - d. Adjust the Horizontal Position knob so the waveform crosses the center vertical graticule at the 10% (amplitude) point of the rising edge. Since the waveform is 2 major divisions high at 500 mp/div, the waveform should be crossing the center vertical graticule at 9 minor divisions below

the center horizontal graticule. This defines the ending reference point for pre-transition aberration measurements.

- e. Push the **FINE** button to turn it off.
- f. In the Meas Setup dialog box:
  - Select **Meas 1** and make sure the **Source1** button is selected.
  - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Amplitude > Max**.
  - Select the **Region** tab.
  - Set Gate **G2** to **46%**.
  - Turn Gates **On** (check).
- g. In the Meas Setup dialog box:
  - Select **Meas 2** and make sure the **Source1** button is selected.
  - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Amplitude > Min**.
  - Select the **Region** tab.
  - Set Gate **G2** to **46%**.
  - Set Gates **On** (check).
- h. The Max and Min measurements are now set to include the region of 250 ps to 20 ps before the edge. The aberration specification over this region is  $\pm 3\%$ , which is  $\pm 30$  mp for a 1  $\rho$  step. Since the reference is  $-1 \rho$ , the Max and Min values should be within  $-1.030$  to  $-0.970 \rho$  to meet the  $\pm 3\%$  specification.
- i. Calculate and take down for later use the peak aberrations in percent using the formulas (with Max and Min in mp units, not  $\rho$ ):
  - Positive aberration (%) =  $(1000 + \text{Max}) * 0.1$
  - Negative aberration (%) =  $(1000 + \text{Min}) * 0.1$

For example: if Max =  $-989$  mp and Min =  $-1.003 \rho$ ,

positive aberration (%) =  $(1000 + (-989)) * 0.1 = +1.1$   
negative aberration (%) =  $(1000 + (-1003)) * 0.1 = -0.3$

---

**NOTE.** *The aberration can have either a positive or negative sign. Both aberrations could have the same sign when the waveform does not cross the reference line in the region being checked.*

---

- j. In the Horz Setup dialog box:
  - Set Horizontal Reference to **50%**.
  - Set Horizontal Scale to **2 ns/div**.
- k. In the Meas Setup dialog box for **Meas2** (Region tab selected), set Gate G2 to **49%**.
- l. Select **Meas1**, set Gate G2 to **49%**.
- m. The Max and Min measurements are now set to include the region of 10 ns to 200 ps before the edge. As before, the aberration specification over this region is  $\pm 3\%$ , so the Max and Min values should be within  $-1.030$  to  $-0.970$   $\rho$ .
- n. Calculate the peak aberrations in percent using the formulas (with Max and Min in mp units, not  $\rho$ ):
  - Positive aberration (%) =  $(1000 + \text{Max}) * 0.1$ .
  - Negative aberration (%) =  $(1000 + \text{Min}) * 0.1$ .
- o. Check that the aberrations for the entire 10 ns to 20 ps region before the edge (from steps i and n) are within  $\pm 3\%$ . If recording data on the Test Record, enter the largest (positive or negative) value.
- 2. Check aberrations in the range of 400 ps to 5 ns after the edge (aberrations within  $\pm 3\%$ ).
  - a. Change the Horizontal Scale to **50 ps/div** while adjusting Horizontal Position to keep the rising edge of the step waveform centered on the display.
  - b. Push the front panel **FINE** button to turn it on.
  - c. Adjust the Horizontal Position knob so the waveform crosses the center vertical graticule at the 90% (amplitude) point of the rising edge. The waveform should be crossing the center vertical graticule at 1 minor division below the center horizontal graticule. This defines the beginning reference for post-transition aberration measurements.
  - d. Push the front panel **FINE** button to turn it off.
  - e. In the Horz Setup dialog box:
    - Set Horizontal Reference to **50%**.

- Set Horizontal Scale to **1 ns/div**.
- f.** In the Meas Setup dialog box, for **Meas1**:
  - Set G1 to **54%**.
  - Set G2 to **100%**.
- g.** In the Meas Setup dialog box, for **Meas2**:
  - Set G1 to **54%**.
  - Set G2 to **100%**.
- h.** The Max and Min measurements are now set to include the region of 400 ps to 5 ns after the edge. The aberration specification over this region is  $\pm 3\%$ , which is  $\pm 30$  mp for a 1  $\rho$  step. The reference level is HiRef, from step 4 e of the setup procedure under *TDR-System Step Response Aberrations (80E08 and 80E10)*.
- i.** Calculate the peak aberrations in percent using the formulas (with Max, Min, and HiRef in mr, not r):
  - Positive aberration (%) =  $(\text{Max} - \text{HiRef}) * 0.1$ .
  - Negative aberration (%) =  $(\text{Min} - \text{HiRef}) * 0.1$ .

For example: if Max = +11 mp and HiRef = –5 mp,  
positive aberration (%) =  $(+11 - (-)) * 0.1 = +1.6$
- j.** Check that the aberrations calculated in step i for the 400 ps to 5 ns region after the edge are within  $\pm 3\%$ . If recording data on the Test Record, enter the largest (positive or negative) value.

3. Check the range >5ns after the edge (aberrations within  $\pm 1\%$ ).
  - a. Change the Horizontal Scale to **10 ns/div**.
  - b. Adjust Horizontal Position so waveform rising edge is at the second vertical graticule (assuming that first graticule is the left edge of display).
  - c. In the Meas Setup dialog box for **Meas2**, set Gate G1 to **15%**.
  - d. In the Meas Setup dialog box for **Meas1**, set Gate G1 to **15%**.
  - e. The Max and Min measurements are now set to include the region of 5 ns to 90 ns after the edge. The aberration specification over this region is  $\pm 1\%$ , which is  $\pm 10$  mp for a 1  $\rho$  step. The reference level is HiRef, from step 4 e of the setup procedure under *TDR-System Step Response Aberrations (80E08 and 80E10)*.
  - f. The Max and Min measurements are now set to include the region of 250 ps to 20 ps before the edge. The aberration specification over this region is  $\pm 1\%$ , which is  $\pm 10$  mp for a 1  $\rho$  step. Since the reference is  $-1\rho$ , the Max and Min values should be within  $-1.010$  to  $-0.990\rho$  to meet the  $\pm 1\%$  specification.
  - g. Calculate and take down for later use the peak aberrations in percent using the formulas (with Max and Min in mp units, not  $\rho$ ):
    - Positive aberration (%) =  $(1000 + \text{Max}) * 0.1$ .
    - Negative aberration (%) =  $(1000 + \text{Min}) * 0.1$ .

For example: if Max =  $-989$  mp and Min =  $-1.003\rho$ ,

positive aberration (%) =  $(1000 + (-989)) * 0.1 = +1.1$

negative aberration (%) =  $(1000 + (-1003)) * 0.1 = -0.3$
4. Repeat the Setup and Test procedures for the TDR negative edge polarity. To do this check, select negative edge polarity after selecting TDR Preset in Setup step 4 a under *TDR-System Step Response Aberrations (80E04)*. No other changes to the procedures are needed, since in rho ( $\rho$ ) mode the display does not invert when the TDR edge polarity is changed.

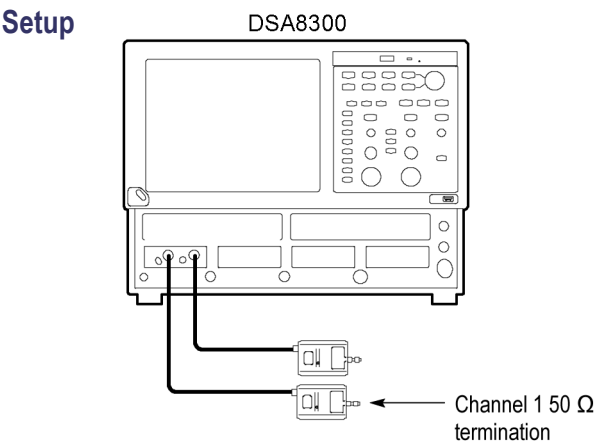
5. Repeat the Setup and Test procedures for channel 2, both polarities.

*End of Procedure*

# TDR-System Step Response Aberrations (80E08 and 80E10)

These procedures check those characteristics that relate to the TDR system and are listed as checked in the *DSA8300 Digital Serial Analyzer Specifications* manual.

<b>Equipment required</b> (See Table 1-1.)	Terminator, 50 $\Omega$ coaxial terminator, K male, 80E08 only (item 28)
	Terminator, 50 $\Omega$ coaxial terminator, V male, 80E10 only (item 29)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .)
	(See page 1-153, <i>Prerequisites</i> .)



**Figure 1-27: TDR system step response aberrations setup**

1. Install the module into the left small module compartment of the main instrument.
2. Connect a 50  $\Omega$  coaxial terminator to channel 1 as shown in the following figure.



3. Push the **DEFAULT SETUP** front-panel button and click **Yes**.
4. Set up the main instrument as follows:
  - a. In the TDR Setup dialog box click **C1 Preset**. This sets up Channel 1 (C1) positive polarity by default; it will later be manually switched to select negative polarity and for channel 2, during the test sequence.
  - b. In the Acq Setup dialog box set the Acquisition Mode to **Average, 128 samples**.
  - c. In the Horz Setup dialog box:
    - Set Record Length to **2000 points**.
    - Set Position to **1  $\mu$ s**.
    - Set Scale to **50  $\mu$ s/div**.
  - d. In the Meas Setup dialog box:
    - Select **Meas 1** and make sure the **Source1** button is selected.
    - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Amplitude > Amplitude**, and check the **On** box.
    - Select the **HiLow** tab and uncheck **Track High** and **Track Low** in the Tracking Method.
  - e. Record for later use the High reference and Low reference measurement values in mp, making sure to take down the proper sign. This will be used as HiRef and LoRef (the high and low reference levels for aberration measurements).

**Test** Follow this procedure to make the aberration checks:

1. Check aberrations in the range of 10 ns to 20 ps before the edge (aberrations within  $\pm 1\%$ ).
  - a. Set the Horizontal Position to its minimum setting using the Horizontal position knob.
  - b. Change the Horizontal Scale to **50 ps/div** while adjusting Horizontal Position, keeping the rising edge of the first step waveform on screen.
  - c. Push the front panel **FINE** button to turn it on.
  - d. Adjust the Horizontal Position knob so the waveform crosses the center vertical graticule at the 10% (amplitude) point of the rising edge. Since the waveform is 2 major divisions high at 500 mp/div, the waveform should be crossing the center vertical graticule at 9 minor divisions below

the center horizontal graticule. This defines the ending reference point for pre-transition aberration measurements.

- e. Push the **FINE** button to turn it off.
- f. In the Meas Setup dialog box:
  - Select **Meas 1** and make sure the **Source1** button is selected.
  - Make sure both the channel under test and Pulse are selected in the Source tab, choose Select Meas > Pulse – Amplitude > Max, and then check the On box.
  - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Amplitude > Max**, and then click the **On** box.
  - Select the **Region** tab.
  - Set Gate **G1** to **0%**.
  - Set Gate **G2** to **46%**.
  - Turn Gates **On** (select).
- g. In the Meas Setup dialog box:
  - Select **Meas 2** and make sure the **Source1** button is selected.
  - Make sure the channel under test is selected in the Source tab, click the **Pulse** Signal Type button, and then choose **Select Meas > Pulse – Amplitude > Amplitude**, and then click the **On** box.
  - Select the **Region** tab.
  - Set Gate **G1** to 0%.
  - Set Gate **G2** to 46%.
  - Set Gates **On** (select).
- h. Calculate and take down for later use the peak aberrations in percent using the formulas (with Max, Min, and LoRef in mp units, not ρ):
  - Positive aberration (%) =  $(\text{Max} - \text{LoRef}) * 0.1 / (\text{HiRef} - \text{LoRef})$ .
  - Negative aberration (%) =  $(\text{Min} - \text{LoRef}) * 0.1 / (\text{HiRef} - \text{LoRef})$ .

For example: if Max=–1.019 ρ, Min=–1.033 ρ, LoRef=–1030 mp, and HiRef=0

positive aberration (%) =  $(-1019 - (-1030)) * (0.1 / (0 - (-1030))) = +1.1$

negative aberration (%) =  $(-1033 - (-1030)) * (0.1 / (0 - (-1030))) = -0.3$

---

**NOTE.** The aberration can have either a positive or negative sign. Both aberrations could have the same sign when the waveform does not cross the reference line in the region being checked.

---

2. Check aberrations in the range of 14 ps to 150 ps after the edge (aberrations within +20% and –2%).
  - a. Push the **DEFAULT SETUP** front-panel button and click **Yes**.
  - b. Open the Trigger Menu dialog box from the instrument front panel, select **TDR**, and set the clock rate to **50 kHz** using the drop down menu.
  - c. Select the **TDR** tab in the menu dialog box. In the Preset column, select **C1** (or whichever channel your module is on).
  - d. Select the **Measurement** tab. Set up Meas1, Meas2, and Meas3 as follows:
    - **Meas1**: Choose **Select Meas > Pulse-Amplitude > + Overshoot**.
    - **Meas2**: Choose **Select Meas > Pulse-Amplitude > Pk-Pk**.
    - **Meas3**: Choose **Select Meas > Pulse-Amplitude > Amplitude**.
  - e. Click the **MATH** front panel button. Create a math trace (M1) to calculate the lower aberration extreme (undershoot) by pressing the following keys in the popup dialog box:
    - Meas1
    - –
    - (
    - 100
    - \*
    - (
    - Meas2
    - /
    - Meas3
    - )
    - )
    - Confirm that the final expression is  $\text{Meas1} - (100 * (\text{Meas2} / \text{Meas3}))$
    - Select the **On** box and click **OK**.
  - f. Select the Measurement tab in the Setup dialog box menu. Set up **Meas4** as follows:
    - Choose **Select Meas > Pulse-Amplitude > Mean**.

- Choose **Source1** and select **M1** in the Source.
- g. Set the time/div to **20  $\mu$ s/div** (use the Horizontal Scale knobs).
- h. Select **Meas3** from the Measurement tab in the setup dialog box menu, select the **HiLow** tab, and unselect the **Track Hi** and **Track Low** boxes.
- i. Repeat step h for **Meas1**.
- j. Change the Horizontal Scale to **50 ps/div** while adjusting Horizontal Position, keeping the rising edge of the first step waveform on screen.
- k. Push the front panel **FINE** button to turn it on.
- l. Adjust the horizontal position such that the incident edge 50% crossing occurs one division in from the left edge of the screen.
- m. Push the front panel **FINE** button to turn it off.
- n. In the Horizontal Setup dialog box, set Horizontal Reference to **10%**.
- o. Select the following measurements from the Setup dialog box menu and set them up as follows:
  - **Meas1**. Select the **Region** tab and set G1 to **10%** (approximately 50% edge crossing threshold), **G2** to **40%** (150 ps), and select the Gates **On** box.
  - **Meas2**. Select the **Region** tab, select the Gates **On** box, set **G1** to slightly before the observed location of the maximum overshoot, and set **G2** to **40%** (150 ps).

---

**NOTE.** *Meas1 now reads overshoot directly on-screen. Meas4 now reads undershoot directly on-screen.*

---

- p. Check that the TDR incident edge aberrations in the range of 14 ps to 150 ps after the edge are within specification:
  - Aberration Upper Spec limit (USL):  $\text{Meas1} + \text{Overshoot}(C1) \leq 20\%$ .
  - Aberration Lower Spec limit (LSL):  $\text{Meas4 Mean}(M1) \geq -2\%$ .

3. Check aberrations in the range of 150 ps to 400 ps after the edge (aberrations within +12% to -2%).
  - a. Set Meas1 and Meas2 as follows:
    - **Meas1**: Select the **Region** tab and set **G1** to **40%** (150 ps) and **G2** to **90%** (400 ps).
    - **Meas2**: Select the **Region** tab and set **G1** to **40%** (150 ps) and **G2** to **90%** (400 ps).
  - b. Check that the TDR incident edge aberrations in the range of 150 ps to 400 ps after the edge are within specification:
    - Aberration Upper Spec limit (USL):  $\text{Meas1} + \text{Overshoot}(C1) \leq +12\%$ .
    - Aberration Lower Spec limit (LSL):  $\text{Meas4 Mean}(M1) \geq -2\%$ .
4. Check aberrations in the range of 400 ps to 5 ns after the edge (aberrations within  $\pm 2\%$ ).
  - a. Change the time/div to **1 ns/div** using the Horizontal Scale knob.
  - b. Set Meas1 and Meas2 as follows:
    - **Meas1**: Select the **Region** tab and set **G1** to **14%** (400 ps) and **G2** to **60%** (5 ns).
    - **Meas2**: Select the **Region** tab and set **G1** to **14%** (400 ps) and **G2** to **60%** (5 ns).
  - c. Check that the TDR incident edge aberrations in the range of 400 ps to 5 ns after the edge are within specification:
    - Aberration Upper Spec limit (USL):  $\text{Meas1} + \text{Overshoot}(C1) \leq +2\%$ .
    - Aberration Lower Spec limit (LSL):  $\text{Meas4 Mean}(M1) \geq -2\%$ .

5. Check aberrations in the range of 5 ns to 100 ns after the edge (aberrations within +1% and -2%).
  - a. Change the time/div to **20 ns/div** using the Horizontal Scale knob.
  - b. Push the front panel **FINE** button to turn it on.
  - c. Adjust the position such that the incident edge 50% crossing occurs at the left edge of the screen.
  - d. Push the front panel **FINE** button to turn it off.
  - e. In the Horizontal Setup dialog box, set Horizontal Reference to **0%**.
  - f. Set Meas1 and Meas2 as follows:
    - **Meas1**: Select the **Region** tab and set **G1** to **2.5%** (5 ns) and **G2** to **50%** (100 ns).
    - **Meas2**: Select the **Region** tab and set **G1** to **2.5%** (5 ns) and **G2** to **50%** (100 ns).
  - g. Check that the TDR incident edge aberrations in the range of 5 ns to 100 ns after the edge are within specification:
    - Aberration Upper Spec limit (USL):  $\text{Meas1} + \text{Overshoot}(C1) \leq +1\%$ .
    - Aberration Lower Spec limit (LSL):  $\text{Meas4 Mean}(M1) \geq -2\%$ .
6. Check aberrations in the range of >100 ns after the edge (aberrations within  $\pm 1\%$ ).
  - a. Change the time/div to **500 ns/div** using the Horizontal Scale knob.
  - b. Set Meas1 and Meas2 as follows:
    - **Meas1**: Select the **Region** tab and set **G1** to **2%** (100 ns) and **G2** to **100%** (5  $\mu$ s).
    - **Meas2**: Select the **Region** tab and set **G1** to **2%** (100 ns) and **G2** to **100%** (5  $\mu$ s).
  - c. Check that the TDR incident edge aberrations in the range >100 ns after the edge are within specification:
    - Aberration Upper Spec limit (USL):  $\text{Meas1} + \text{Overshoot}(C1) \leq +1\%$ .
    - Aberration Lower Spec limit (LSL):  $\text{Meas4 Mean}(M1) \geq -1\%$ .
7. Repeat the Setup and Test procedures for the TDR negative edge polarity. To do this check, select negative edge polarity after selecting TDR Preset in Setup step 4 a under *TDR-System Step Response Aberrations (80E04)*. No other changes to the procedures are needed, since in rho ( $\rho$ ) mode the display does not invert when the TDR edge polarity is changed.
8. Repeat the Setup and Test procedures for channel 2, both polarities.

*End of Procedure*

# Optical Sampling Modules

The following performance verification procedures for the optical sampling modules check the characteristics that are shown as checked specifications (✓ symbol) in the optical module tables of the *DSA8300 Digital Serial Analyzer Specifications* manual.

## Prerequisites

Be sure you have performed the appropriate *Prerequisites* before doing any procedures in this section. (See page 1-17, *Prerequisites*.)

**NOTE.** The procedures throughout this chapter contain instructions based on the menus and controls from the most updated instrument software available at the time this document was released. These procedures will work for other versions of software, but some control and menu names may vary slightly.

## Dark Level and Vertical Equivalent Optical Noise

This procedure checks the dark level, which is the offset in the optical channel caused by thermal variations or finite leakage current. This procedure also checks the vertical equivalent optical noise. The checks are made with vertical offset set to zero and no optical signal input to the optical sampling module (dustcap installed on the OPTICAL INPUT).

<b>Equipment required</b> (See Table 1-1.)	Terminator, 50 $\Omega$ coaxial, SMA male; used with optical sampling modules with clock recovery (CR) (item 30)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .) (See page 1-198, <i>Prerequisites</i> .)

### Setup

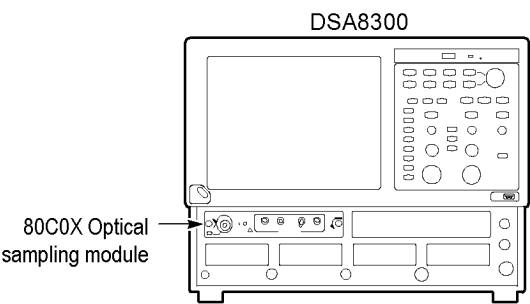


Figure 1-28: Dark level and vertical equivalent optical noise test setup



1. Install the 80CXX Optical Sampling Module into Channel 1 of the main instrument
2. Install the black, fiber-optic dustcap onto the OPTICAL INPUT connector of the optical sampling module.
3. If the optical sampling module has clock recovery, install 50  $\Omega$  terminations on the outputs.
4. Push the **DEFAULT SETUP** front-panel button and click **Yes**.
5. Select **C1** for the waveform source (use the waveform selector button in the lower left corner of the application display).
6. In the Mode/Trigger dialog box, select **TDR** for the Trigger Source.

---

**NOTE.** *If the Scale, Position, and Channel Offset control boxes are not displayed in the following step, click the Basic button in the lower left part of the Vert Setup dialog box.*

---

7. In the Vert Setup dialog box, do the following:
  - a. Set the Scale to one of the following values:
    - **100  $\mu$ W/div** for 80C01, 80C02, 80C04, 80C05, 80C09, and 80C11 Optical Sampling Modules
    - **5  $\mu$ W/div** for 80C03, 80C07, and 80C07B Optical Sampling Modules
    - **200  $\mu$ W/div** for 80C06, 80C10, 80C10B, or 80C25GBE Optical Sampling Modules
    - **1  $\mu$ W/div** for 80C08, 80C08B, 80C08C, and 80C12 Optical Sampling Modules
    - **3  $\mu$ W/div** for 80C12B and 80C14 Optical Sampling Modules
  - b. Set Position to **0.0div**.
  - c. Set Channel Offset to **0.0W**.

8. In the Horiz Setup dialog box do the following:
  - a. Set Scale to **1.000 ns/div**.
  - b. Set Record Length to **500**.
9. In the Hist Setup dialog box, do the following:
  - a. Select **Main C1** as the Source.
  - b. Check **Enable Histogram**.
  - c. Select **Vertical**.
  - d. Close the Hist Setup dialog box.

**Test** Follow this procedure to make the Dark Level and Vertical Equivalent Optical Noise checks:

1. In the Utilities menu, select **System Properties**. Check that the Mainframe Current On-Time is greater than 0.33 hours (20 minutes).

---

**NOTE.** *The values in System Properties dialog box do not update while the dialog box is open. Close the dialog box and reopen it to get updated values.*

---

2. Close the System Properties dialog box.
3. Select **Utilities > Compensation**.
4. Make the following selections in the Compensation dialog box:
  - a. Under Select Action, select **Compensate**.
  - b. Select **Module** in the pull-down menu.
  - c. Select **Ch1**.
5. Click **Execute**, and then click **OK** to the message box that appears.
6. Wait until the compensation is completed (hour glass cursor reverts back to arrow cursor). It is recommended that you store this compensation result in the module as the Stored User values. To store the compensation results in the module, do the following procedure:
  - a. In the Select Action section of the Compensation dialog box, select **Save**.
  - b. In the Storage section, make sure **User** is selected.
  - c. Click the **Execute** button. This saves the compensation results in the module.
7. Click **Close** to close the Compensation dialog box.

8. In the Vert Setup dialog box, click the **Optical >>** button. This displays fields for setting up the vertical optical parameters.
9. Select a bandwidth or filter in the Vert Setup dialog box. Refer to the following table for available settings.
10. In the Vert Setup dialog box, click the **Dark Level** compensate button.
11. Push the **CLEAR DATA** button on the instrument front panel.

---

**NOTE.** *If the Vert Setup dialog box covers the Histogram statistics readout at the right side of the display, click in the Setups title bar and drag the dialog box to the left until you can see the Histogram statistics.*

---

12. After a few seconds, note the Mean and the Std Dev results displayed on the right side of the display for the selected bandwidth or filter. The mean of the histogram is the dark level value and the standard deviation of the histogram is the maximum RMS vertical equivalent optical noise value. Record these values in the Dark Level and Vertical Equivalent optical noise sections of the test record for the optical sampling module that you are testing.
13. Repeat steps 9 through 12 for each bandwidth and filter available for the optical sampling module that you are testing.

---

**NOTE.** *Select **Setup > Vertical** and click the **Optical** button (if not already in the optical settings) to access the filter and bandwidth settings for the optical sampling module you are testing.*

---

*End of Procedure*

## Minimum Optical Bandwidth and Reference Receiver Frequency Response

Before performing the checks for minimum optical bandwidth and reference receiver frequency response, 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  $\Omega$  termination of a sampler) is the  $V_{\text{RMS}}^2/R$  where  $V_{\text{RMS}}$  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:

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

For electrical bandwidths, the power ratio is used so:

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

when

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

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

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

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

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:

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

therefore at

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

In the DSA8300, the vertical units displayed for an optical module are not in voltage, but are in watts, which is a unit of power. The O/E converter inside the module 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 optical sampling modules, 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 optical modules via impulse testing, the resulting impulse waveform is converted to frequency via Fourier transform, and the bandwidth is defined as:

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

This definition is used for 2.3 GHz, 2.5 GHz, 12.5 GHz, 20 GHz, 30 GHz, 40 GHz, 50 GHz, 65 GHz, and 80 GHz 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:

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

This definition is used for all NRZ reference receiver settings in all the modules.

### 80C01-80C09, 80C11, 80C12, 80C12B, and 80C14 Procedure

This procedure checks the minimum optical bandwidths and the reference receiver frequency responses of all 80C0X Optical Sampling Module except the 80C10, 80C10B, and 80C25GBE. To test the minimum optical bandwidths and the reference receiver frequency response of the 80C10, 80C10B, and 80C25GBE modules, go to *80C10 and 80C10B Test*. (See page 1-209, *80C10, 80C10B, and 80C25GBE Test*.)

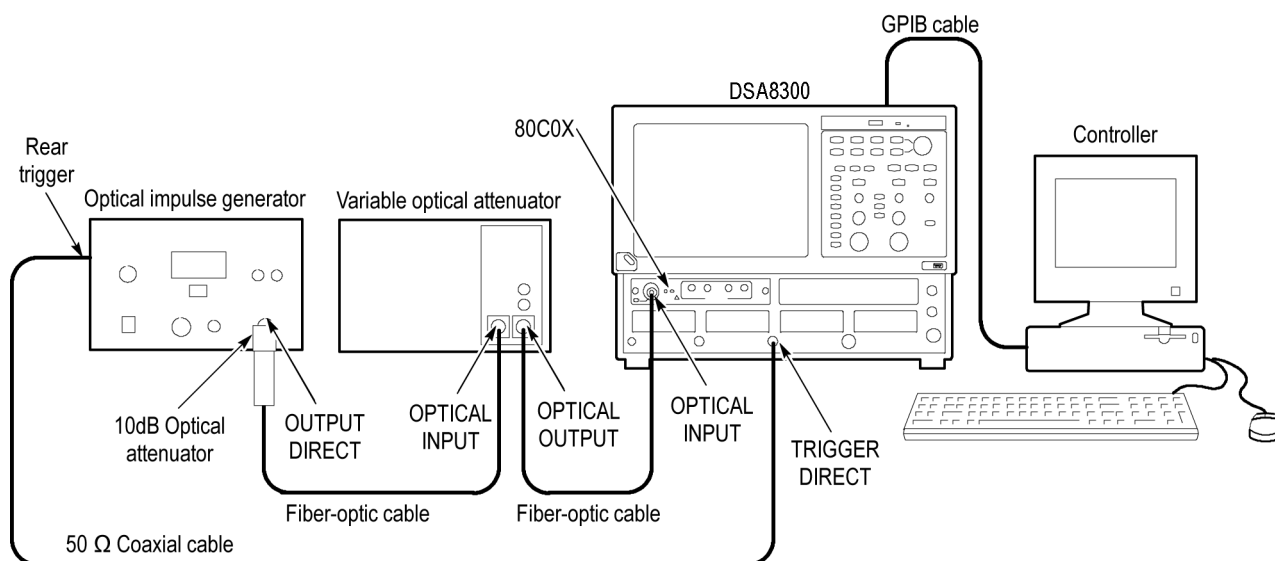
**NOTE.** *To optimize performance, make sure that all connections are clean and secure and that all components of the system are in good condition. Optical fiber can gradually degrade the system performance as it is repeatedly flexed over time.*

<b>Equipment required</b> (See Table 1-1.)	Optical attenuator, 10 dB, FC-FC, female-male connectors (item 8) Single-mode fiber-optic cable, 2 m, FC to FC connectors (item 13) Cable, coaxial, 1 m, male to male SMA connectors (item 16) Variable optical attenuator, Tektronix OA5002 (item 21) Optical impulser, Calmar FPL-01 (item 22) Optical sampling module 80C01-80C09, 80C11, 80C12, 80C12B, 80C14
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .) (See page 1-198, <i>Prerequisites</i> .)

Before performing this procedure, be sure you have completed the *Dark level and Vertical Equivalent Optical Noise* procedure. (See page 1-198, *Dark Level and Vertical Equivalent Optical Noise*.)

**NOTE.** *Because of interpolation errors in the FFT calculation of the impulse response, the 80C06 module is not tested like the other modules in this section. Instead, we integrate the impulse response to generate a step and then measure the 10% to 90% risetime of this step response. For the 80C06, go to the Integrated Rise Time and Aberrations. (See page 1-215, Integrated Rise Time and Aberrations Check.)*

- Setup** 1. Install the 80C0X Optical Sampling Module into Channel 1 of the instrument.



**Figure 1-29: Minimum optical bandwidth and reference receiver frequency response setup**


2. Connect the 10 dB optical attenuator to the output of the optical impulse generator.
3. Connect a fiber-optic cable between the 10 dB optical attenuator and the input of the OA5002 variable optical attenuator.
4. Connect a fiber-optic cable between the output of the variable optical attenuator and the OPTICAL INPUT of the optical sampling module.
5. Connect a 50  $\Omega$  coaxial cable from the rear trigger (SYN) on the optical impulse generator to the TRIGGER DIRECT input on the instrument.
6. 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.

---

7. Push the **SELECT ON/OFF** button on the 80C0X Optical Sampling Module so that the adjacent indicator lights. This turns on Channel 1 (C1) on the 80C0X-CR Optical Sampling Module.
8. In the Setup menu, select Acquire and make the following changes in the Acq Setup dialog box:
  - a. Select **Average** as the acquisition mode.
  - b. Set the number of samples to **64** Samples.

9. In the Mode/Trigger dialog box, do the following:
  - a. Set the trigger source to **Direct**.
  - b. Click the **Advanced Trigger Setup** button.
  - c. Click the **Set to 50%** button to set the trigger point midway on the rising signal.
  - d. Set the Slope value to Rising Edge ().
  - e. **Close** the Advanced Trigger Setup dialog box.
10. In the Horiz Setup dialog box, do the following;
  - a. Set the Scale to **1.000 ns/div**. (This setting will make it easier to initially locate the optical pulse later in the procedure.)
  - b. Set the Position to **18.000 ns**. (This setting will make it easier to locate the first optical pulse later in the procedure.)
  - c. Set the Record Length to **2000**.
11. In the Disp Setup dialog box, do the following:
  - a. Set the Style to **Normal**.
  - b. Click **Show Vectors**.

12. In the Vert Setup dialog box, do the following:

---

**NOTE.** *If the Scale, Position, and Channel Offset control boxes are not displayed in the following step, click the Basic>> button in the lower left part of the Vert Setup dialog box.*

---

- a. Set the Scale to **500.0  $\mu$ W/div** (or a lower setting if 500.0  $\mu$ W is not available).
- b. Set Position to **0.0 div**.
- c. Set Channel Offset to **0.0 W**.
- d. Click the **Optical** button in the lower left part of the Vert Setup dialog box.
- e. Set Wavelength to **1550 nm**.
- f. Set the Bandwidth or Filter to the highest bandwidth setting available for the optical sampling module under test, using the following table:

■ 80C01	Filter to None	Bandwidth to 20.000 GHz
■ 80C02	Filter to None	Bandwidth to 30.000 GHz
■ 80C03	Filter to None	Bandwidth 2 GHz
■ 80C04	Filter to None	Bandwidth to 30.000 GHz
■ 80C05	Filter to None	Bandwidth to 40.000 GHz
■ 80C07	Filter to None	Bandwidth to 2.0 GHz
■ 80C07B	Filter to None	Bandwidth to 2.5 GHz
■ 80C08	Filter to None	Bandwidth to 10.000 GHz
■ 80C08B	Filter to None	Bandwidth to 10.000 GHz
■ 80C08C	Filter to None	Bandwidth to 10.000 GHz
■ 80C09	Filter to None	Bandwidth to 30.000 GHz
■ 80C11	Filter to None	Bandwidth to 30.000 GHz
■ 80C12	Filter to None	Bandwidth to 9 GHz
■ 80C12-10G	Filter to None	Bandwidth to 10 GHz
■ 80C12B	Filter to None	Bandwidth to 12 GHz
■ 80C14	Filter to None	Bandwidth to 14 GHz

- g. Position the cursor in the title bar of the Setups dialog box and drag the box to the right side of the display.



13. Use the Horizontal **POSITION** knob to position the impulse at the first horizontal division as shown in the following figure. (This ensures that post-impulse aberrations are included in the record.)
14. Adjust the attenuation of the variable optical attenuator as follows:
  - If you are testing an 80C01, 80C02, 80C04, 80C09, or 80C11 Optical Sampling Module, adjust it until it produces an impulse pulse amplitude of **1.5 mW<sub>p-p</sub>** to 2.5 mW<sub>p-p</sub>.
  - If you are testing an 80C03, 80C07, 80C07B, 80C08, 80C08B, 80C08C or 80C12 Optical Sampling Module, adjust the attenuator for a **200 μW<sub>p-p</sub>** pulse amplitude.
  - If you are testing an 80C05 optical sampling module, adjust the attenuator for a **10 mW<sub>p-p</sub>** pulse amplitude.
  - If you are testing an 80C12B optical sampling module, adjust the attenuator for a **425 μW<sub>p-p</sub>** pulse amplitude.
  - If you are testing an 80C14 optical sampling module, adjust the attenuator for a **500 μW<sub>p-p</sub>** pulse amplitude.

**Test** Follow this procedure to make the minimum optical bandwidth and reference receiver frequency response checks:

---

**NOTE.** *The minimum optical bandwidth is not checked for the 80C03 Optical Sampling Module. If testing this module, go to step 10 in this procedure and continue with this procedure to check the reference receiver frequency responses.*

---

1. Use the Horizontal **POSITION** knob to position the impulse at the first horizontal division as shown in the following figure. (This ensures that post-impulse aberrations are included in the record.)

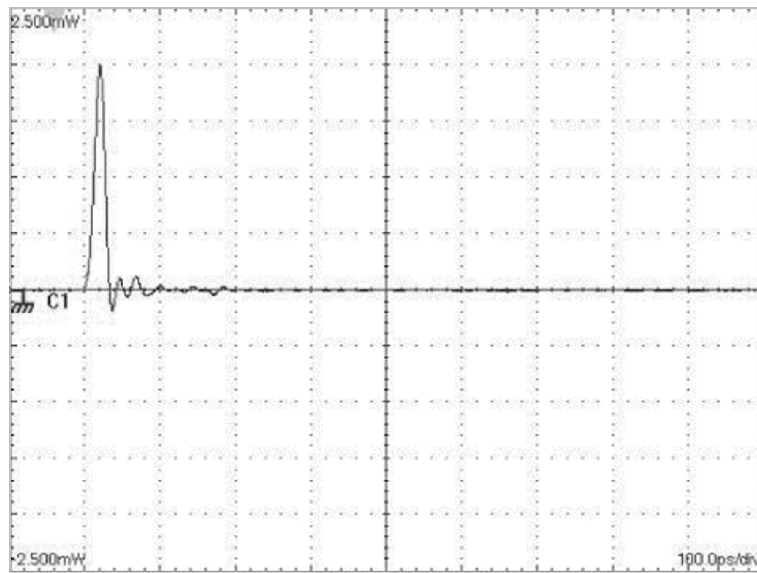
You may experience signal jitter if you try to display a signal that is not the first impulse and is late in relation to time zero.

2. Adjust the Horizontal **SCALE** knob so that the width of the impulse at its base is approximately 1/4 to 3/4 of a horizontal division on the display as shown in the following figure.

---

**NOTE.** *If the width of the impulse is much greater than 3/4 of a horizontal division, the resulting Fourier transform will not have enough frequency resolution; if the width is much smaller than 1/4 of a horizontal division, the amount of samples that fall on the impulse may be too coarse, resulting in quantum errors in the resulting Fourier transform.*

---



**Figure 1-30: Proper positioning of the impulse for optimum curve download**

3. Using a controller (such as a PC, Macintosh, or workstation) attached to the main instrument via GPIB, download the waveform.

---

**NOTE.** *Alternatively, you can use the Save Waveform, Copy Waveform, or a network connection to transfer a waveform curve to a spreadsheet, ASCII file, or other application.*

---

4. Using the available controller software, such as LabVIEW, perform a Fourier Transform on the waveform to transform the time-domain impulse response to a scalar frequency response.
5. Normalize the Fourier Transform result such that DC or low frequency is **0 dB**.
6. Plot the frequency response.
7. Check that the optical sampling module meets the performance requirements for the bandwidth setting chosen, as noted in the module test record.
8. Repeat steps 1 through 7 for the remaining bandwidth settings for the optical module under test (refer to the module test record).
9. In the Vert Setup dialog box, select a Filter (see the test record for filters available for the optical sampling module under test).
10. Do steps 1 through 6.

11. Refer to the module test record and check that the optical sampling module meets the limits listed for the tested filter.
12. Repeat steps 9 through 11 for each of the filters available for the optical sampling module that you are testing.

### 80C10, 80C10B, and 80C25GBE Test

This procedure checks the minimum optical bandwidths and the reference receiver frequency responses of the 80C10, 80C10B, and 80C25GBE Optical Sampling Modules only. To test bandwidths and responses minimum of all other optical sampling modules, use the *80C01-80C09*, *80C11*, *80C12*, *80C12B* and *80C14 Procedure* instead. 80C01-80C09, 80C11, 80C12, 80C12B and 80C14 Procedure (See page 1-203, *80C01-80C09*, *80C11*, *80C12*, *80C12B*, and *80C14 Procedure*.)

<b>Equipment required</b> (See Table 1-1.)	Optical wavelength meter (item 23) Photodetector, >1 GHz bandwidth (item 33) Polarization Maintaining fiber coupler (50/50) (item 34) Polarization Maintaining tap coupler (5/95) (item 35) PM fiber jumper cable (FC/APC and FC/PC connector) (item 36) SMA fiber jumper cable (FC/APC and FC/PC connector) (item 37) Tektronix 500 MHz real-time scope (item 40) Tunable ECL lasers (Qty. 2); See Tunable Laser Requirements, below (item 41) Optical sampling module 80C10, 80C10B, 80C25GBE
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .) (See page 1-198, <i>Prerequisites</i> .)

### Tunable Laser Requirements

The lasers used for this test meet the following requirements:

- The lasers must be a tunable External Cavity Laser (ECLs), which has a narrow line width and high side-mode suppression ratio (>50 dB) that result in single frequency emission.
- The lasers must have an absolute wavelength accuracy of <1 pm, where the wavelength of the sweep laser is measured during the sweep using a high

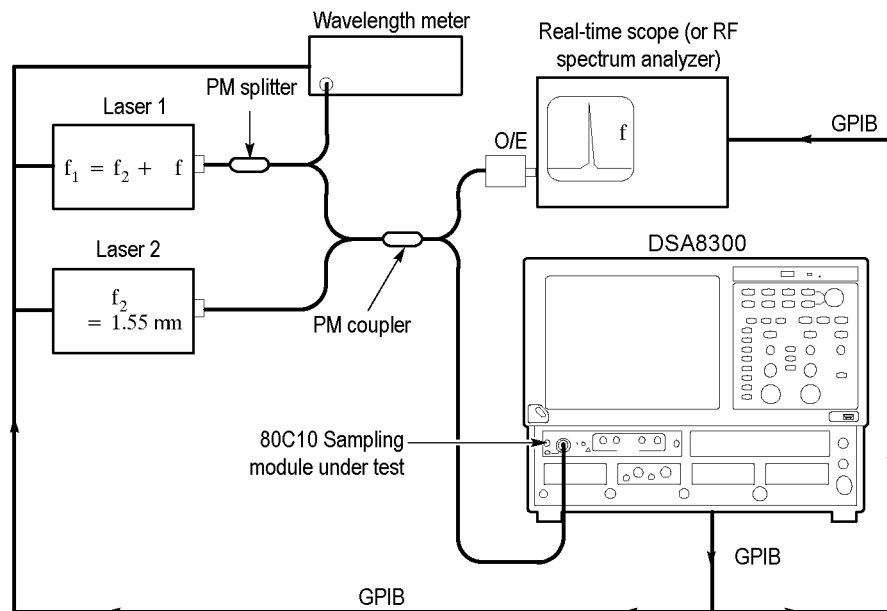
precision optical wavelength meter <sup>1</sup>. The sweep laser must be mode-hop free over the sweep range.

- The lasers must be matched to each other for polarization and power, to achieve near 100% modulation. For example:
  - Align the axis of polarization of the two lasers at the input to the module under test with an extinction ratio of >20 dB. To do so, use lasers with Polarization-Maintaining (PM) output fibers and use PM fibers and PM components in the entire setup.
  - Adjust the power of the lasers to be equal at the input to the module under test. See step 7.

<sup>1</sup> For the optical wavelength meter, the relative accuracy and display resolution must be 1 pm (wavelengths are vacuum values).

**Setup** Install the test hookups, and preset the main instrument controls:

1. Install the 80C10, 80C10B, or 80C25GBE Optical Sampling Module into Channel 1 of the main instrument.



**Figure 1-31: Setup for heterodyne test**

2. Make sure the module under test is properly compensated. (See page 1-3, *Instrument and Module Compensation*.)

**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.

3. Connect a PM fiber-optic cable between the OPTICAL output of the Laser 1 and the PM splitter. Connect the input of the PM splitter to the OPTICAL output of laser 1.
4. Connect the 5% output of the PM splitter to the wavelength meter; connect the other output of the PM splitter to the PM coupler.
5. Connect a PM fiber-optic cable between the OPTICAL output of the Laser 2 and the PM coupler. Connect the second input of the PM coupler to the OPTICAL output of laser 2.
6. Connect one output of the PM coupler to the O/E converter on the real-time scope or RF spectrum analyzer; connect the other output of the PM coupler to the 80C10, 80C10B, or 80C25GBE module in the main instrument.
7. Verify the following settings on both Laser 1 and Laser 2:
  - a. Instantaneous Laser linewidth: **<300 kHz**.
  - b. Side-mode suppression ratio: **>50 dB**.
  - c. Power stability is  **$\leq \pm 0.025$  dB** during the duration of sweep and over wavelength range of sweep. This must be verified before continuing this procedure. If the lasers do not meet this specification, apply correction values as shown in the following substeps:
    - In performing steps 3 and 4, at each frequency point (including the DC reference point) record the mean value from the histogram statistics:  $m_i$
    - The corrected normalized response values (dB) are calculated using (also see the equation in step 6 b):
 
$$R(f_i) = 10 \times \log \left( \sqrt{\frac{\sigma_i^2 - \sigma_b^2}{\sigma_0^2 - \sigma_b^2}} \times \frac{m_0}{m_i} \right)$$
  - d. Adjust the power of each laser so that the powers are equal and so that average input to the module under test is **1.75 – 2 mW** each (this setting results in a modulation amplitude of 7 - 8 mW).
8. Push the **DEFAULT SETUP** button on the instrument front panel. Click Yes in the dialog box that appears.
9. Select **C1** for the waveform source (use the waveform selector button in the lower left corner of the application display).
10. In the Mode/Trigger dialog box, set the Trigger Source to TDR. Use the default **200 kHz** setting.

11. Set the Acq Mode to Sample in the instrument tool bar.

---

**NOTE.** If the Scale, Position, and Channel Offset control boxes are not displayed in the following step, click the Basic button in the lower left corner of the Vert Setup dialog box.

---

12. In the Vert Setup dialog box, use the default settings.
13. In the Horiz Setup dialog box, set the Scale to 1.000 ns/div.
14. In the Hist Setup dialog box, do the following steps:
  - a. Select Main C1 as the Source.
  - b. Check Enable Histogram.
  - c. Select Vertical (limits are 0-100%).
  - d. Close the Hist Setup dialog box.
  - e. See the setup illustration in the following figure.

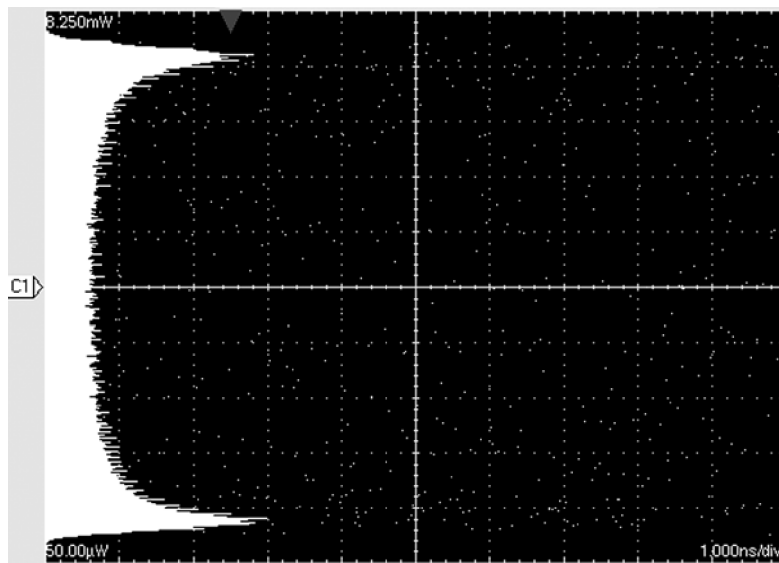


Figure 1-32: Setup used for heterodyne sweep

**Test** Follow this procedure to test the 80C10, 80C10B, or 80C25GBE:

---

**NOTE.** The values in System Properties dialog box do not update while the dialog box is open. Close the dialog box and reopen it to get updated values.

---

1. Set lasers to the DC starting point at (1550 nm):
  - a. Adjust laser wavelengths to within 0.5 pm of each other by monitoring the beat note directly on the real-time scope. (See Figure 1-31.)
  - b. Adjust laser wavelengths until the beat frequency is  $<150$  MHz, and record the frequency  $f_{DC}$ . This is the DC reference point.
2. For Vertical scale:
  - a. Set the vertical position to **0**.
  - b. Record the mean and peak-to-peak value from the histogram statistics.
  - c. Set vertical offset to the mean value recorded in the previous step.
  - d. Adjust the vertical scale so that the peak-to-peak amplitude covers about 95% of the vertical range.
3. Record DC reference values (see note in step 11 under Setup):
  - a. Push **Clear Data**.
  - b. Acquire a histogram with **250,000** hits.
  - c. Record the standard deviation from the histogram statistics:  $\sigma_0$ .
  - d. Record the wavelength of the sweep laser:  $\lambda_0$ .
4. Perform the frequency sweep to at least 1.5 x bandwidth. The recommended frequency step size is **1 GHz** ( $\cong 8$  pm laser step size). For each frequency point, perform the following steps (see note in step 11 under Setup):
  - a. Step to and park sweep laser at next wavelength.
  - b. Allow the laser to stabilize.
  - c. Push **Clear Data**.
  - d. Acquire a histogram with **250,000** hits.
  - e. Record the standard deviation from the histogram statistics:  $\sigma_i$
  - f. Record the wavelength of the sweep laser:  $\lambda_i$
5. Record background standard deviation (due to laser and sampling module noise).
  - a. Set laser detuning to  $\geq 750$  GHz.
  - b. Push **Clear Data**.
  - c. Acquire a histogram with **250,000** hits.
  - d. Record the standard deviation from the histogram statistics:  $\sigma_b$

**6. Calculate the normalized frequency response curve:**

- a.**
- The frequency values are given by:

$$f_i = c \times \left( \frac{1}{\lambda_i} - \frac{1}{\lambda_0} \right) + f_{DC}$$

where  $c = 2.9979 \times 10^8$  m/s (vacuum speed of light)

- b.**
- The corresponding response values (dB) normalized to the lowest frequency point ("DC") are given by:

$$R(f_i) = 10 \times \log \left( \sqrt{\frac{\sigma_i^2 - \sigma_b^2}{\sigma_0^2 - \sigma_b^2}} \right)$$

**7. Check that the optical bandwidth is greater than or equal to that stated below for each bandwidth setting.**

- a.**
- The optical bandwidth is determined by the frequency point where the response curve crosses the –3 dB line. The limits follow:

Module	Bandwidth setting	Bandwidth limit
80C10, 80C10B	30 GHz	>30 GHz
80C10, 80C10B, 80C25GBE	65 GHz	>60 GHz
80C10B	80 GHz	>75 GHz

You select the bandwidth settings for the module under test from the Bandwidth control box in the Vert Setup dialog box.

- b.** For Optical Reference Receivers the frequency response curves and Bessel-Thompson tolerances are plotted on an electrical power scale (20log) by convention. In this case, the response values given in 6 b) have to be multiplied by a factor of 2.
- 8.** In the Vert Setup dialog box, select the Filter (see the module test record for filters to test for that module).
- 9.** Perform steps 1 through 6.
- 10.** Refer to the module test record and check that the optical sampling module meets the limits listed for the applicable reference receiver filter.
- 11.** Repeat steps 9 through 11 for each of the filters available for the 80C10 or 80C10B module.

*End of Procedure*



## Integrated Rise Time and Aberrations Check

This procedure checks the integrated rise time of an 80C06 Optical Sampling Module and the aberrations of an 80C05, 80C06, 80C10, 80C10B, or 80C25GBE Optical Sampling Module.

**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.*

<b>Equipment required</b> (See Table 1-1.)	Single-mode fiber-optic cable, 2 m, FC to FC connectors (item 13) Cable, coaxial, 1 m, male to male SMA connectors (item 16) Variable optical attenuator, Tektronix OA5002 (item 21) Optical impulser, Calmar FPL-01 (item 22)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .) (See page 1-198, <i>Prerequisites</i> .)

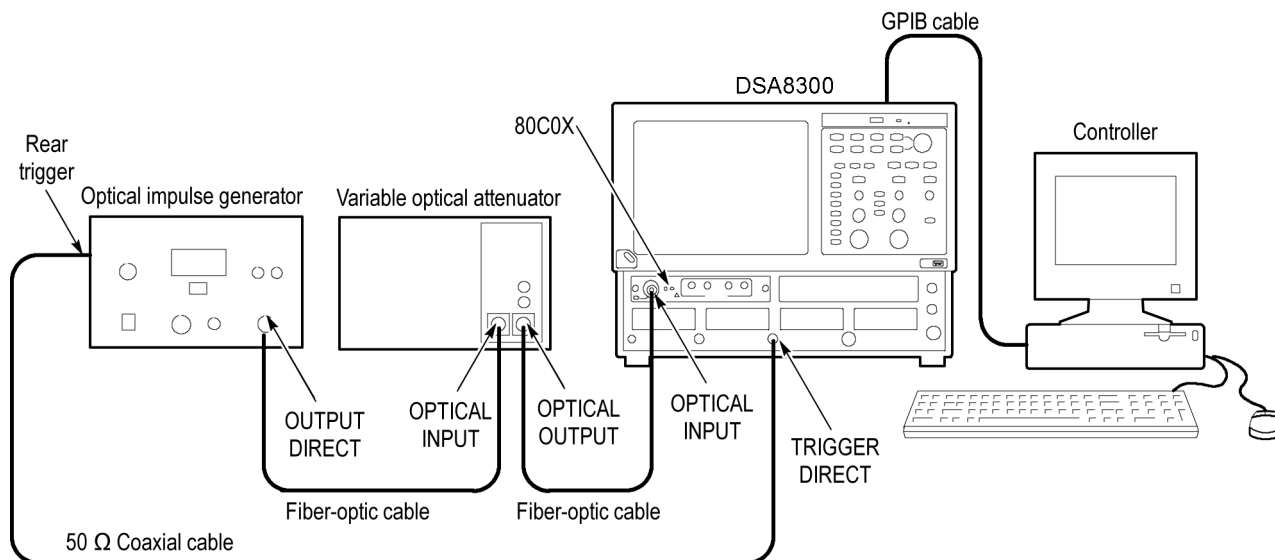
Before performing this procedure, be sure you have completed the *Dark level and Vertical Equivalent Optical Noise* procedure. (See page 1-198, *Dark Level and Vertical Equivalent Optical Noise*.)

### Setup

Install the test setup as shown in the following figure and preset the main instrument controls:

1. Install the 80C0X Optical Sampling Module into Channel 1 of the instrument.
2. Connect a fiber-optic cable between the output of the optical impulse generator and the input of the OA5002 variable optical attenuator.
3. Connect a fiber-optic cable between the output of the OA5002 variable optical attenuator and the optical input of the optical sampling module.
4. Connect a 50  $\Omega$  coaxial cable from the rear trigger (SYN) on the optical impulse generator to the TRIGGER DIRECT INPUT on the instrument.
5. 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.*



**Figure 1-33: Integrated rise time and aberrations setup**

6. Push the **SELECT ON/OFF** button on the optical sampling module so that the adjacent indicator lights. This turns on Channel 1 (C1) on the module.
7. In the Setup menu, select **Acquire** and click **Sample** as the acquisition mode.
8. In the Mode/Trigger dialog box, do the following:
  - a. Select **Direct** for the trigger source.
  - b. Click the **Advanced Trigger Setup** button.
  - c. Click **Set to 50%** to set the trigger point midway on the rising signal.
  - d. Select the **rising edge** for Slope.
  - e. **Close** the Advanced Trigger Setup dialog box.
9. In the Horiz Setup dialog box, do the following:
  - a. Set the Scale to **1.000 ns/div**. (This setting will make it easier to initially locate the optical pulse later in the procedure.)
  - b. Set the Position to **30.000 ns**. (This setting will make it easier to locate the first optical pulse later in the procedure.)
  - c. Set the Record Length to **2000**.
10. In the Disp Setup dialog box, do the following:
  - a. Click **Normal** for Style.
  - b. Click **Show Vectors**.

11. In the Vert Setup dialog box, do the following:
  - a. Set the Scale to **500.0  $\mu$ W/div**.
  - b. Set Position to **0.0 div**.
  - c. Set Channel Offset to **0.0 W**.
  - d. Click the **Optical >>** button in the lower left part of the Vert Setup dialog box.
  - e. Set Wavelength to **1550 nm**.
  - f. Set the Bandwidth to:
    - **40 GHz** for 80C05
    - **50 GHz** for 80C06
    - **65 GHz** for 80C10, 80C10B-F1, or 80C25GBE
    - **80 GHz** for 80C10B
12. Use the Horizontal POSITION knob to position the impulse at the second horizontal division.
13. Use the Horizontal POSITION and SCALE knobs to:
  - For 80C05, 80C10, 80C10B, or 80C25GBE decrease the Horizontal SCALE to **40 ps/div**.
  - For 80C06, decrease the Horizontal SCALE to **20 ps/div**.
  - Position the impulse at the **second horizontal division**.
14. Use the Vertical SCALE knob to increase the vertical scale to **2 mW/div**.
15. Adjust the attenuation of the variable optical attenuator to an impulse amplitude of **14 mW p-p** to **16 mW p-p**.
16. Select Meas Dialog box and make the following changes:
  - a. Select **Meas 1** and make sure the **Source1** button is selected.
  - b. Make sure **C1 on Main** is selected, click **Pulse**, and then choose **Select Meas > Pulse – Amplitude > Mean**.
  - c. Make sure the Meas 1 **ON** check box is selected.
  - d. Click the **Region** tab.
  - e. Enter **0%** for G1 and **5%** for G2. Check the On box to turn Gates on.
17. Push the **MATH** button on the front panel to open the Define Math dialog box.
18. Enter the following formula:
 
$$100 * \text{Avg}(\text{Intg}(\text{C1} - \text{Meas1}))$$

19. Set Num Avgs field to **100**.
20. Check that the M1 **On** box is selected.
21. Click **OK** at the bottom of the menu.

---

**NOTE.** For an 80C05, 80C10, 80C10B, or 80C25GBE module skip steps 22 and 23.

---

22. Select the Meas Setup dialog box and make the following changes:
  - a. Select **Meas 2** and make sure the **Source1** button is selected.
  - b. In the Source tab area, select **M1 on Main**, click the **Pulse** button, and then choose measurement **Select Meas > Pulse – Timing > Rise Time**.
  - c. Make sure the Meas 2 **ON** check box is selected.
23. Set the bandwidth and note the risetime measurement according to the following:

80C06	Bandwidth 50 GHz	Rise Time 9.6 ps (typical)
-------	------------------	----------------------------

24. Adjust the attenuator until the displayed amplitude of the impulse is **4 mW**.  
Adjust the Horizontal position until the impulse peak is at the second division.
25. Select the Meas Dialog box and make the following changes:
  - a. Select **Meas 3**, check **On**, and make sure the **Source1** button is selected.
  - b. In the Source tab, select Main M1 (Math 1) as the source, click the **Pulse** button, and then choose **Select Meas > Pulse – Amplitude > Pk-Pk**.
  - c. Select **Meas 4**, check **On**, and make sure the **Source1** button is selected.
  - d. Select Main M1 (Math 1) as the source and Pulse as signal type in the Source tab, and then choose **Select Meas > Pulse – Amplitude > Pk-Pk**.
  - e. Click the Region tab. Turn the gates on by checking the box next to **On**.
  - f. Adjust G1 and G2 as follows:
    - For 80C05 or 80C06, increase G1 until it is immediately to the left of the peak of the first rising edge, which should be approximately at the second division. Move G2 until the time difference between G1 and G2 is 5 times the rise time from the rising edge. See the following table for the time difference between G1 and G2 for the different bandwidth and filter settings.
    - For 80C10, 80C10B, or 80C25GBE increase G1 until it is 15 ps after the 50% point of the rising edge. Move G2 until the time difference between G1 and G2 is 10 times the rise time from the rising edge. See

the following table for the time difference between G1 and G2 for the different bandwidth and filter settings.

**Table 1-9: Minimum limits**

Optical sampling module	Bandwidth/filter setting	Time difference
80C05	40 GHz	G2-G1 = 65 ps (5 x 13 ps)
	30 GHz	G2-G1 = 85 ps (5 x 17 ps)
	20 GHz	G2-G1 = 125 ps (5 x 25 ps)
	OC192	G2-G1 = 235 ps (5 x 47 ps)
80C06	50 GHz	G2-G1 = 48 ps (5 x 9.6 ps)
80C10	65 GHz	G2-G1 = 74 ps (10 x 7.4 ps)
	30 GHz	G2-G1 = 160 ps (10 x 16 ps)
	OC768	G2-G1 = 120 ps (10 x 12 ps)
	FEC43.02	G2-G1 = 112 ps (10 x 11.2 ps)
80C10B	80 GHz	G2-G1 = 60 ps (10 x 6.0 ps)
	65 GHz	G2-G1 = 74 ps (10 x 7.4 ps)
	30 GHz	G2-G1 = 160 ps (10 x 16 ps)
	OC768	G2-G1 = 120 ps (10 x 12 ps)
	FEC43.02	G2-G1 = 112 ps (10 x 11.2 ps)
	40GBase-FR	G2-G1 = 119 ps (10 x 11.9 ps)
80C10B-F1	65 GHz	G2-G1 = 74 ps (10 x 7.4 ps)
	OC768	G2-G1 = 120 ps (10 x 12 ps)
	FEC43.02	G2-G1 = 112 ps (10 x 11.2 ps)
	40GBase-FR	G2-G1 = 119 ps (10 x 11.9 ps)
	100GBase-xR4 FEC	G2-G1 = 192 ps (10 x 19.2 ps)
	100GBase-xR4	G2-G1 = 192 ps (10 x 19.2 ps)
80C25GBE	65 GHz	G2-G1 = 74 ps (10 x 7.4 ps)
	100GBase-xR4 FEC	G2-G1 = 192 ps (10 x 19.2 ps)
	100GBase-xR4	G2-G1 = 192 ps (10 x 19.2 ps)

- 26.** To calculate the Time Domain Vertical Response Aberrations, divide Measurement 4 by Measurement 3 and multiply by 100. The aberration limits for the 80C05, 80C06, 80C10, 80C10B and 80C25GBE modules are listed in the following table.

**Table 1-10: Aberrations**

Optical sampling module	Bandwidth/filter setting	Aberrations
80C05	40 GHz	<15%
	30 GHz	<10%
	20 GHz	<10%
	OC192	<5%

Table 1-10: Aberrations (cont.)

Optical sampling module	Bandwidth/filter setting	Aberrations
80C06	50 GHz	<10%
80C10	65 GHz	<10%
	30 GHz	<5%
	FEC43.02	<5%
	OC768	<5%
80C10B	80 GHz	<12%
	65 GHz	<10%
	30 GHz	<5%
	FEC43.02	<5%
	OC768	<5%
	40GBase-FR	<5%
80C10B-F1	65 GHz	<10%
	OC768	<5%
	FEC43.02	<5%
	40GBase-FR	<5%
	100GBase-xR4 FEC	<5%
	100GBase-xR4	<5%
80C25GBE	65 GHz	<10%
	100GBase-xR4 FEC	<5%
	100GBase-xR4	<5%

## Clock Recovery Optical Sensitivity Range and Recovered Clock Timing Jitter

This procedure checks the clock recovery optical sensitivity range and the recovered clock timing jitter on 80C0X optical sampling modules that are equipped with clock recovery options.

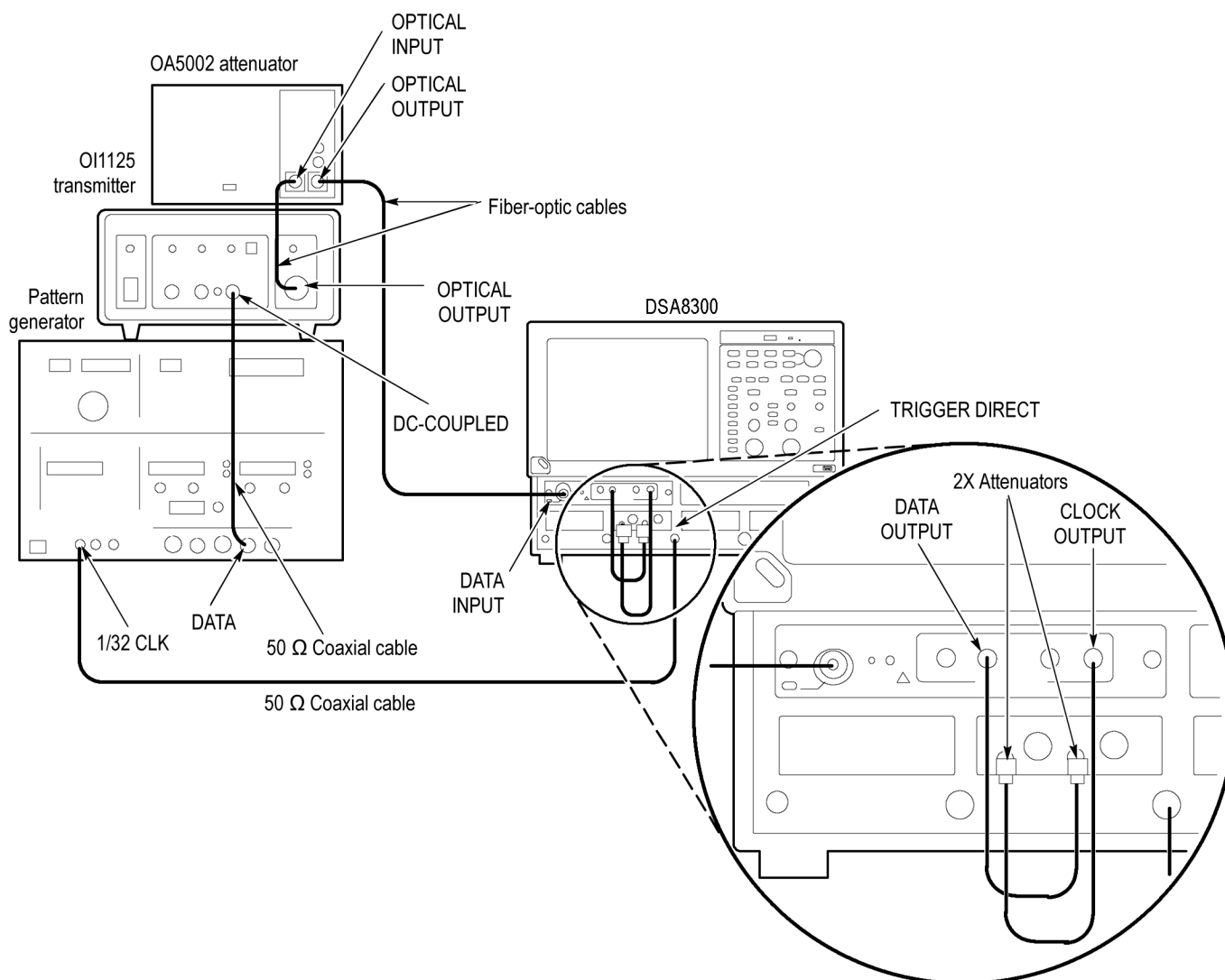
<b>Equipment required</b> (See Table 1-1.)	Attenuator, 2X (6 dB pad), 50 $\Omega$ , SMA (item 7) Cable, coaxial, 2 ns delay SMA, male connector each end (item 12) Single-mode fiber-optic cable, 2 m, FC to FC connectors (item 13) Optical Transmitter and Receiver (item 20) Variable optical attenuator, Tektronix OA5002 (item 21) Tektronix 80C02 Sampling Module (item 32) Pattern Generator, Advantest D3186 (item 38) 80C0X Optical sampling module that supports clock recovery
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .) (See page 1-198, <i>Prerequisites</i> .)

Before performing this procedure, be sure you have completed the *Dark level & Vertical Equivalent Optical Noise* procedure. (See page 1-198, *Dark Level and Vertical Equivalent Optical Noise*.)

**Setup**

Install the test setup as shown in the following figure and preset the main instrument controls:

1. Install the 80C0X Optical Sampling Module into Channel 1 of the instrument.
2. Install the 80E02 Sampling Module into Channels 3 and 4 of the instrument. (Channel 1 and Channel 2 are disabled when an optical sampling module is installed in the upper Channel 1.)
3. Install 2X SMA electrical attenuators on the inputs of the 80E02 Sampling Module (to prevent saturation).
4. Connect a less than 2 ns delay, 50  $\Omega$  coaxial cable between the 1/32 CLK signal output of the pattern generator and the TRIGGER DIRECT INPUT connector on the instrument.
5. Connect a less than 2 ns delay, 50  $\Omega$  coaxial cable between the DATA output of the pattern generator and the DIGITAL IN DC-COUPLED input on the laser transmitter.
6. Connect a single-mode fiber-optic cable between the OPTICAL output of the laser transmitter and the OPTICAL INPUT on the variable optical attenuator.



**Figure 1-34: Clock recovery optical sensitivity range and recovered clock timing jitter setup**

7. Connect a single-mode fiber-optic cable between the OPTICAL OUTPUT of the variable optical attenuator and the OPTICAL INPUT of the 80C0X-CR Optical Sampling Module.
8. Connect a less than 2 ns delay, 50  $\Omega$  coaxial cable between the CLOCK OUTPUT of the 80C0X-CR Optical Sampling Module and the Channel 3 input on the 80E02 Sampling Module.
9. Connect a less than 2 ns delay, 50  $\Omega$  coaxial cable between the DATA OUTPUT of the 80C0X-CR Optical Sampling Module and the Channel 4 input on the 80E02 Sampling Module.
10. The D3186 Pulse Pattern Generator must use its own reference clock. Set the following data signal parameters on the pattern generator:



- AC coupled
- DATA output mode                    -2 V
- Amplitude                                0.700 V
- Offset                                     -1.00 V
- PRBS23 pattern
- NRZ data format
- Balanced duty cycle (crossing set to the default 50% level)
- Data rate to 2.48832 Gb/s (the data rate will be changed, depending on each specific data rate to be tested later in the procedure)

11. Set the variable optical attenuator for minimum attenuation.
12. Allow the instrument and its modules to warm up for at least 20 minutes in an environment that has had less than 1 °C variation throughout the warm-up cycle.
13. Push the **DEFAULT SETUP** button on the instrument and click **Yes**.
14. Push the **SELECT ON/OFF** button on the 80C0X Optical Sampling Module so that the adjacent indicator lights. This turns on Channel 1 (C1) on the 80C0X-CR Optical Sampling Module.
15. Push the **SELECT ON/OFF** button on the 80E02 Sampling Module so that the adjacent indicator lights. This turns on Channel 3 (C3), which displays the CLOCK signal.
16. Select **Setup > Mode/Trigger** in the main menu. Make the following changes:
  - a. Set the Trigger Source to **Direct**.
  - b. Click the **Advanced Trigger Setup** button.
  - c. Click the **Set to 50%** button.
  - d. Select **positive edge** for the Slope.
  - e. **Close** the Advanced Trigger Setup dialog box.
17. Select the Meas Setup dialog box. Make the following changes:
  - a. Select **Meas 1** and make sure the **Source1** button is selected.
  - b. In the Source tab, select **C1 on Main** and click the **NRZ** button.
  - c. Choose measurement **Select Meas > NRZ – Amplitude > Average Optical Power**.
  - d. Make sure the Meas 1 **ON** check box is selected.
18. Select the Vert Setup dialog box tab and make the following changes:
  - a. Select **C1** for Waveform.
  - b. Set the Wavelength to match the wavelength of the laser transmitter.

19. Select the Wfm Database Setup dialog box tab and make the following changes:
  - a. Select database **WfmDb 1**, and select **C3 on Main** as the Source.
  - b. Set Database1 to **On**.
20. Select the Meas Setup dialog box tab and make the following changes:
  - a. Select **Meas 2** and make sure the **Source1** button is selected.
  - b. In the Source tab, select **C3 on Main** and click the **NRZ** button.
  - c. Choose measurement **Select Meas > NRZ – Timing > RMS Jitter**.
  - d. Make sure the Meas 2 **ON** check box is selected.
  - e. Select **Use Wfm Database**.

**Test** Follow this procedure to make the clock recovery optical sensitivity range and recovered clock timing jitter checks:

1. In the Mode/Trigger dialog box, select the clock recovery rate for C1 that you want to test as shown in the following table.

---

**NOTE.** Leave Direct selected as the Trigger Source, even though you are selecting a rate other than None. In this preliminary setup, the clock recovery circuitry is enabled for the 80C0X-CR Optical Sampling Module, but the main instrument timebase receives its trigger events from the TRIGGER DIRECT input signal and not the actual recovered clock.

---

2. Set the data rate of the D3186 Pulse Pattern Generator to the rate setting for the clock recovery rate that you selected in step 1 as shown in the following table).
3. Adjust the Horizontal SCALE knob on the front panel of the instrument to the setting listed in the table for the clock recovery rate that you selected in step 1 as shown in the following table.

**Table 1-11: Clock recovery settings**

Optical sampling module	Clock recovery rate	D3186 rate setting	DSA8300 scale setting
80C01-CR	OC-12	0.62208 Gb/s	500 ps/div
	OC-48	2.48832 Gb/s	100 ps/div
80C02-CR	OC-192	9.95328 Gb/s	50 ps/div
80C03-CR	FC-1063	1.0625 Gb/s	200 ps/div
	GBE	1.2500 Gb/s	200 ps/div
	OC-48	2.48832 Gb/s	100 ps/div
	2.5 Gb/s	2.5000 Gb/s	100 ps/div

Table 1-11: Clock recovery settings (cont.)

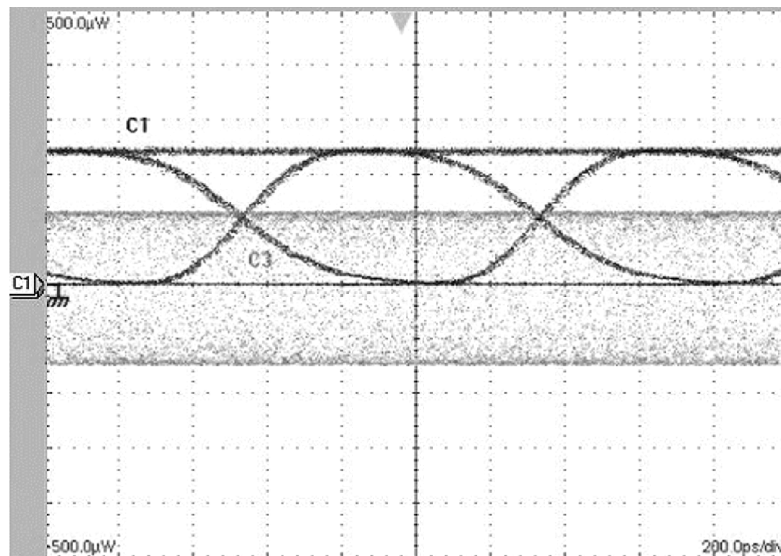
Optical sampling module	Clock recovery rate	D3186 rate setting	DSA8300 scale setting
80C04-CR1	OC-192	9.95328 Gb/s	50 ps/div
80C04-CR2	OC-192	9.95328 Gb/s	50 ps/div
	FEC10.6646	10.6646 Gb/s	50 ps/div
80C07-CR	OC-3	0.15552 Gb/s	1 ns
	OC-12	0.62208 Gb/s	500 ps/div
	OC-48	2.48832 Gb/s	100 ps/div
80C07B-CR	OC-3	0.15552 Gb/s	1 ns
	OC-12	0.62208 Gb/s	500 ps/div
	OC-48	2.48832 Gb/s	100 ps/div
	FC1063	1.0625 Gb/s	200 ps/div
	GBE	1.25 Gb/s	200 ps/div
	FC2125	2.125 Gb/s	100 ps/div
	2GBE	2.5 Gb/s	100 ps/div
	Infiniband	2.5 Gb/s	100 ps/div
80C08-CR	10GBASE-W	9.95328 Gb/s	50 ps/div
	10GBASE-R	10.3125 Gb/s	50 ps/div
80C08B-CR1	10GBASE-W	9.95328 Gb/s	50 ps/div
	10GBASE-R	10.3125 Gb/s	50 ps/div
80C08B-CR2	10GFC	10.51875 Gb/s	50 ps/div
	10GBASE-R	10.3125 Gb/s	50 ps/div
80C08C-CR1	10GBASE-W	9.95328 Gb/s	50 ps/div
	10GBASE-R	10.3125 Gb/s	50 ps/div
80C08C-CR2	10GFC	10.51875 Gb/s	50 ps/div
	10GBASE-R	10.3125 Gb/s	50 ps/div
80C08C-CR4	Continuous	9.8 Gb/s to 12.6 Gb/s	50 ps/div
80C09-CR1	FEC10.71	10.799225 Gb/s	50 ps/div
	OC-192	9.95328 Gb/s	50 ps/div
80C11-CR1	OC-192	9.95328 Gb/s	50 ps/div
80C11-CR2	OC-192	9.95328 Gb/s	50 ps/div
	10.66 FEC	10.66423 Gb/s	50 ps/div
80C11-CR3	OC-192	9.95328 Gb/s	50 ps/div
	FEC10.71	10.709225 Gb/s	50 ps/div
80C11-CR4	Continuous	9.8 Gb/s to 12.6 Gb/s	50 ps/div

At this point in the procedure, the main instrument is triggered from the 1/32 clock from the D3186 Pulse Pattern Generator. The clock signal from the 80Cxx-CR Optical Sampling Module that is connected to C3 on the 80E02

Sampling Module should be synchronous with the signal from the pulse pattern generator. (See Figure 1-36.)

If the signals are not synchronous as shown in the following figure), check that the D3186 data rate is set to a data rate that matches the clock recovery rate set for the 80C0X-CR Optical Sampling Module. (See Table 1-11.)

The following figure is an example of the display when the clock signal from the Optical Sampling Module is not synchronous with the data rate input. Note the unstable (“washed out”) clock signal. Compare this with the next figure, in which the clock signal is synchronized.



**Figure 1-35: Display example (clock signal not synchronized with the data rate input)**

4. Once you have verified that the recovered clock signal (C3) is locked with the incoming data, select the Mode/Trigger dialog box tab, Click **Clock** as the Trigger Source, and select **C3 Clock Recovery** as the Trigger Source.
5. Do the following substeps to check the clock recovery optical sensitivity range:
  - a. Find the module under test listed in the following table.
  - b. Adjust the variable optical attenuator until the Average Optical Power (AOP) measurement for C1 matches the value given in the AOP Measurement **Max optical power** column for the module under test.
  - c. Check that the clock signal remains stable.
  - d. Adjust the variable optical attenuator until the Average Optical Power (AOP) measurement for C1 matches the value given in the AOP Measurement **Min optical power** column for the module under test.
  - e. Check that the clock signal remains stable.

Table 1-12: Clock recovery settings and jitter limits

Module & clock recovery rate		Max optical power	Min optical power	Max RMS Jitter
80C01-CR	OC-12	Not specified, set to -9.0 dBm (125 $\mu$ W)	Not specified, set to -9.0 dBm (125 $\mu$ W)	8 ps
	OC-48			
80C02-CR	OC-192	Not specified, set to -7.5 dBm (178 $\mu$ W)	-7.5 dBm (178 $\mu$ W)	2 ps
80C03-CR	FC-1063	-4 dBm (400 $\mu$ W)	-16.0 dBm (100 $\mu$ W)	8 ps
	GBE			
	OC-48			
	2.5 Gb/s			
80C04-CR1	OC-192	+7.0 dBm (5 mW)	-10.0 dBm (100 $\mu$ W)	2.0 ps
80C04-CR2	OC-192	+7.0 dBm (5 mW)	-10.0 dBm (100 $\mu$ W)	2.0 ps
	FEC10.6646			
80C07-CR	OC-3	-4 dBm (400 $\mu$ W)	-16.0 dBm (25 $\mu$ W)	32.0 ps
	OC-12			8.0 ps
	OC-48			4.0 ps
80C07B-CR	OC-3	-4 dBm (400 $\mu$ W) (All wavelengths)	-16.0 dBm (25 $\mu$ W) (1550 nm and 1310 nm)	32.0 ps
	OC-12			8.0 ps
	OC-48			4.0 ps
	FC1063			8.0 ps
	FC2125			3.0 ps
	ENET1250			8.0 ps
	ENET2500			4.0 ps
	INFINIBAND			4.0 ps
80C08-CR	OC-192	+0.0 dBm (1 mW)	-15 dBm (32 $\mu$ W)	2.0 ps
	10GBASE-W			
	10GBASE-R			
80C08B-CR1	OC-192	+0.0 dBm (1 mW)	-15 dBm (32 $\mu$ W)	2.0 ps
	10GBASE-W			
	10GBASE-R			
80C08B-CR2	10GFC	+0.0 dBm (1 mW)	-15 dBm (32 $\mu$ W)	2.0 ps
	10GBASE-R			
80C08C-CR1	OC-192	+0.0 dBm (1 mW)	-15 dBm (32 $\mu$ W)	2.0 ps
	10GBASE-W			
	10GBASE-R			
80C08C-CR2	10GFC	+0.0 dBm (1 mW)	-15 dBm (32 $\mu$ W)	2.0 ps
	10GBASE-R			
80C09-CR1	FEC10.799225	Not specified, set to -7.5 dBm (178 $\mu$ W)	-7.5 dBm (178 $\mu$ W)	2.0 ps

**Table 1-12: Clock recovery settings and jitter limits (cont.)**

Module & clock recovery rate		Max optical power	Min optical power	Max RMS Jitter
80C11-CR1	OC-192	+7.0 dBm (5 mW)	-10.0 dBm (100 $\mu$ W)	2.0 ps
80C11-CR2	OC-192	+7.0 dBm (5 mW)	-10.0 dBm (100 $\mu$ W)	2.0 ps
	10Gb FEC			
80C11-CR3	OC-192	+7.0 dBm (5 mW)	-10.0 dBm (100 $\mu$ W)	2.0 ps
	G.709 FEC			

**6.** Do the following substeps to check recovered clock timing jitter:

- a.** If you are checking an 80C01 or an 80C03 module, set the Average Optical Power (AOP) to **125  $\mu$ W** (–9.0 dBm); otherwise, leave the AOP set as it was set for step 5 d.
- b.** Zoom into the 50% crossing point of the first rising edge on the C3 clock signal until the Horizontal SCALE is **10 ps/div** and the Vertical SCALE is **10 mV/div**. (See Figure 1-37.)

---

**NOTE.** You can most easily zoom in on the 50% crossing point by clicking and dragging a rectangle around this edge, and then using the SCALE and FINE control knobs to adjust the settings to 10 mV/div and 10 ps/div.

---

- c.** Check that the RMS jitter measurement for C3 is less than or equal to the value given in the maximum RMS jitter column of the table. (See Table 1-12.)
- d.** Repeat this procedure from step 1 to check the recovered clock optical sensitivity and timing jitter for each of the clock recovery rates of the optical sampling module you are testing. (See Table 1-11.)

The following figure is an example of the display when the clock signal from the Optical Sampling Module is synchronous with the data rate input from the pulse pattern generator. Note the stable clock signal waveform. Compare this the previous figure, in which the clock signal is not synchronized.

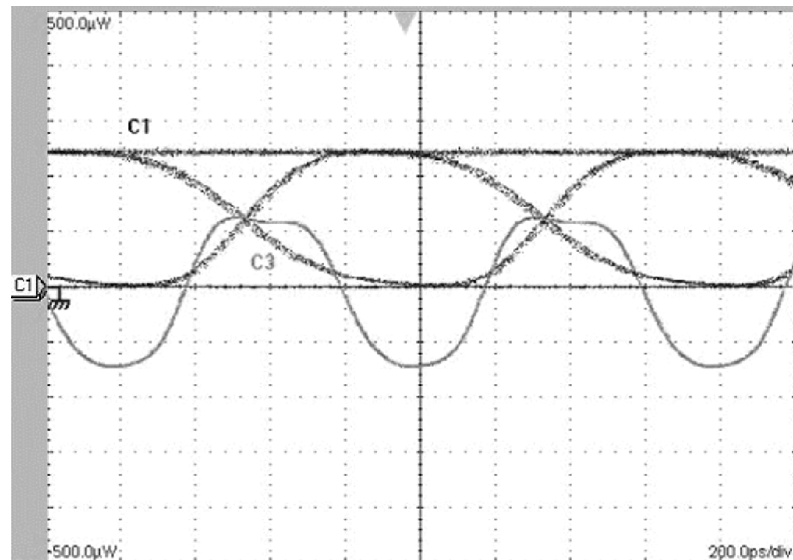


Figure 1-36: Display example (clock signal synchronized with the data rate input)

The following figure is an example of the display zoomed in to 10 mV/div and 10 ps/div at the crossing point (50%) on the recovered clock signal (C3)

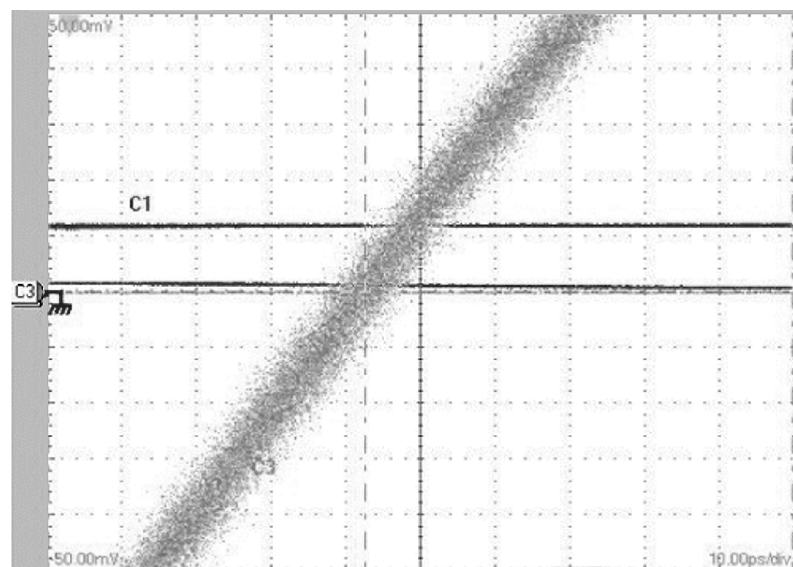


Figure 1-37: Display example (zoomed in at the crossing point)

*End of Procedure*



## 80A02 EOS/ESD Protection Module

These procedures check those characteristics that relate to 80A02 module and are listed as checked specifications in the *DSA8300 Digital Serial Analyzer Specifications* manual.

---

**NOTE.** *The procedures throughout this chapter contain instructions based on the menus and controls from the most updated instrument software available at the time this document was released. These procedures will work for other versions of software, but some control and menu names may vary slightly.*

---

### Prerequisites

Be sure you have performed the following prerequisites and the *Prerequisites* under *Performance Tests* before doing any procedures in this section.

- Install the 80A02 module in one of the small compartments in the main instrument.

---

**NOTE.** *Use a calibrated torque wrench when making connections to a module's connectors. Use  $8 \pm 0.3$  inch pounds of torque.*

---

### Logic Control Threshold

<b>Equipment required</b> (See Table 1-1.)	Variable DC power supply (item 19) Stereo mini phone plug (with exposed connections) (item 57)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .) (See page 1-231, <i>Prerequisites</i> .)

## Setup

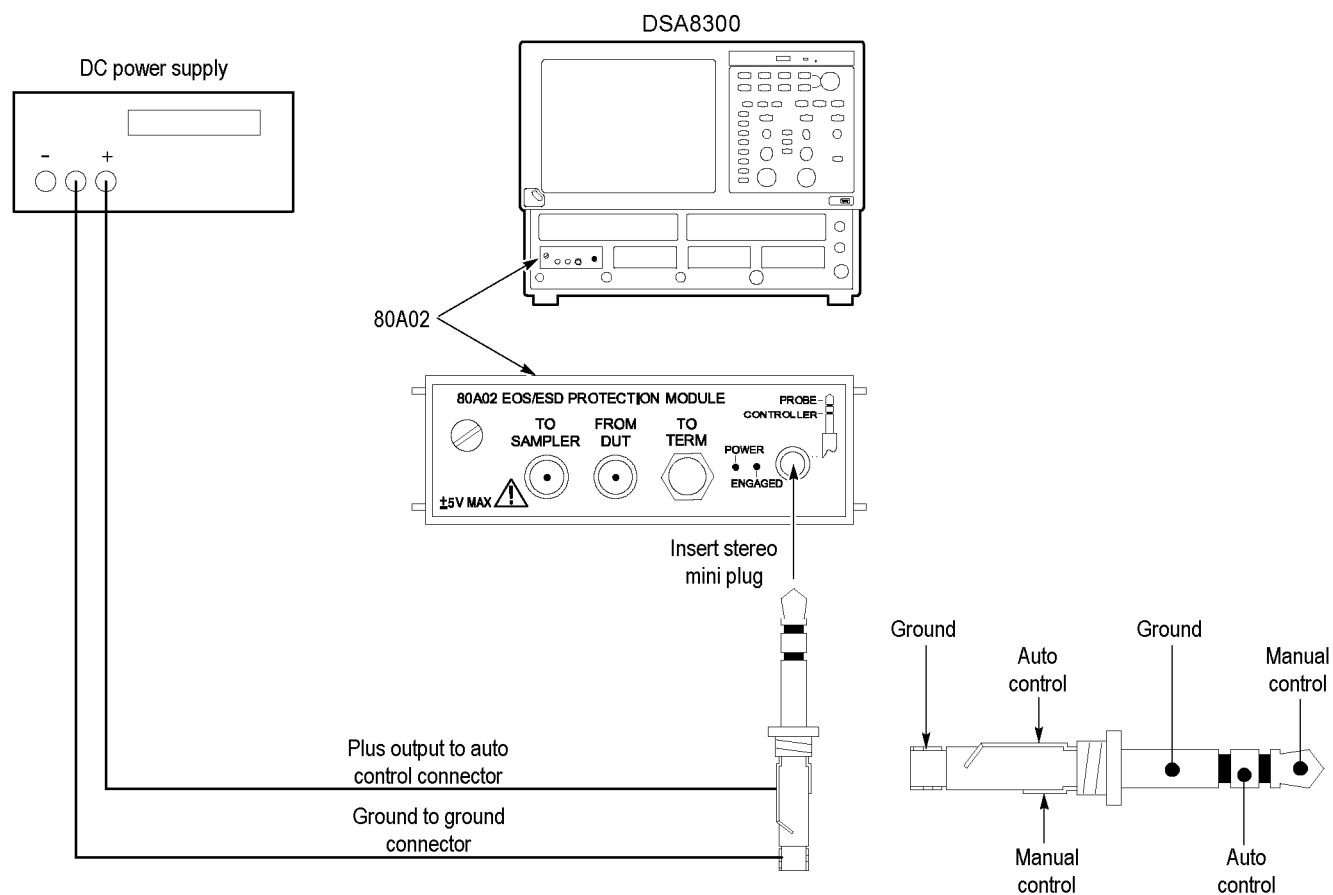


Figure 1-38: 80A02 test setup

1. Insert the stereo mini phone plug into the PROBE CONTROLLER connector of the 80A02.
2. Connect the voltage source to the stereo mini phone plug as follows:
  - a. Identify the connection of the phone plug that is the auto control portion of the phone plug.
  - b. Set the voltage supply to **0 V** and connect the **plus** supply to the **auto control connection**. Connect the voltage supply **ground** to the **ground portion of the phone plug**.

**Test** Follow this procedure to make the control threshold check:

1. Check the auto control operation of the 80A02 module:
  - a. Check that the relay in the 80A02 module does not activate (no click sound) and that the ENGAGED LED does not light while adjusting the DC supply from **0** to **300 mV**.
  - b. Check that the relay in the 80A02 module activates (click sound) and that the ENGAGED LED lights while adjusting the DC supply from 1 V to 5 V.
  - c. Disconnect the voltage supply.
2. Remove the mini phone plug.

*End of Procedure*

# 80A05 Electrical Clock Recovery Module

These procedures check those characteristics that relate to 80A05 module and are listed as checked specifications in the *DSA8300 Digital Serial Analyzer Specifications* manual.

---

**NOTE.** *The procedures throughout this chapter contain instructions based on the menus and controls from the most updated instrument software available at the time this document was released. These procedures will work for other versions of software, but some control and menu names may vary slightly.*

---

## Prerequisites

Be sure you have performed the following prerequisites and the *Prerequisites* under *Performance Tests* before doing any procedures in this section.

- Install the 80A05 module in one of the small compartments in the main instrument.

---

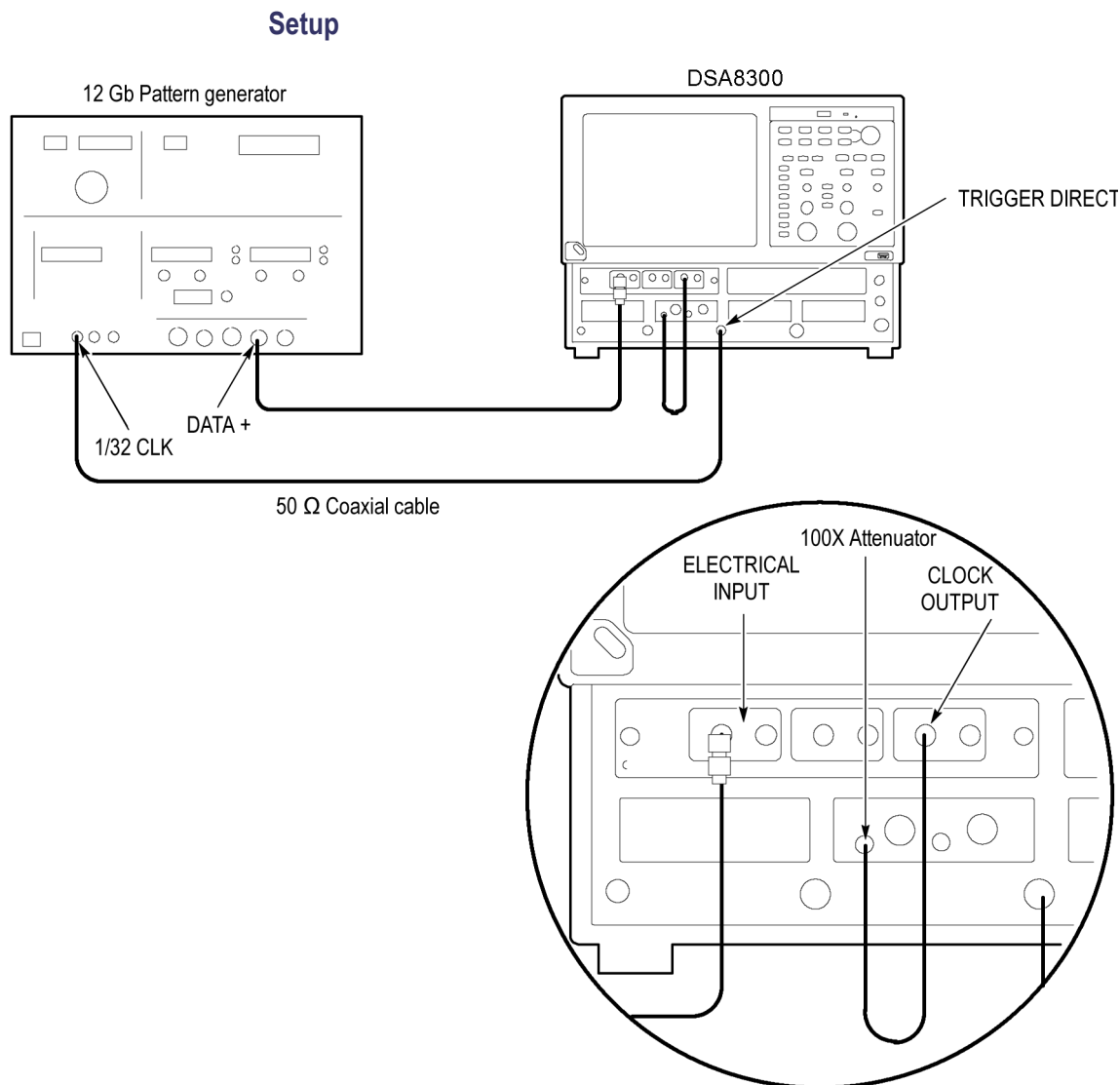
**NOTE.** *Use a calibrated torque wrench when making connections to a module's connectors. Use  $8 \pm 0.3$  inch pounds of torque.*

---

## Clock Recovery Sensitivity Range and Recovered Clock Timing Jitter

This procedure checks the clock recovery sensitivity range and the recovered clock timing jitter on the 80A05 module.

<b>Equipment required</b> (See Table 1-1.)	Cable, coaxial, 2 ns delay SMA, male connector each end (item 12)
	Tektronix 80C02 Sampling Module (item 32)
	Pulse Pattern Generator, Advantest D3186 (item 38)
	Attenuator, 10X (20 dB pad), 50 $\Omega$ , SMA (item 56)
<b>Prerequisites</b>	(See page 1-17, <i>Prerequisites</i> .)
	(See page 1-234, <i>Prerequisites</i> .)



**Figure 1-39: Clock recovery sensitivity range and recovered clock timing jitter setup**

1. Install the 80A05 Clock Recovery Module into Channel 1 of the instrument.
2. Install the 80E02 Sampling Module into Channels 3 and 4 of the instrument.
3. Connect a less than 2 ns delay, 50 Ω coaxial cable between the 1/32 CLK signal output of the pattern generator and the TRIGGER DIRECT INPUT connector on the instrument.
4. Install 2 10X (20 dB) SMA electrical attenuators (in series, creating 100X attenuation) on the ELECTRICAL INPUT IN+ of the 80A05 Module.
5. Connect a less than 2 ns delay, 50 Ω coaxial cable between the DATA + OUTPUT of the pattern generator and the ELECTRICAL INPUT IN+ of the 80A05.

6. Connect a less than 2 ns delay, 50  $\Omega$  coaxial cable between the TRIGGER CLOCK OUTPUT of the 80A05 Module and the Channel 3 input on the 80E02 Sampling Module.
7. The D3186 Pulse Pattern Generator must use its own reference clock. Set the following data signal parameters on the pattern generator:
  - AC coupled
  - Amplitude 0.700 V
  - PRBS23 pattern
  - NRZ data format
  - Balanced duty cycle (crossing set to the default 50% level)
  - Data rate to 0.15552 Gb/s (the data rate will be changed, depending on each specific data rate to be tested later in the procedure)
8. Allow the instrument and its modules to warm up for at least 20 minutes in an environment that has had less than 1 °C variation throughout the warm-up cycle.
9. Push the **DEFAULT SETUP** button on the instrument and click **Yes**.
10. Push the **SELECT ON/OFF** button on the 80E02 Sampling Module so that the adjacent indicator lights. This turns on Channel 3 (C3), which displays the TRIGGER CLOCK signal.

11. Select **Setup > Mode/Trigger** from the instrument main menu. Make the following changes:
  - a. Set the Trigger Source to **Direct**.
  - b. Click the **Advanced Trigger Setup** button.
  - c. Click the **Set to 50%** button.
  - d. Select **positive** edge for the Slope.
  - e. **Close** the Advanced Trigger Setup dialog box.
12. Select the Meas Setup dialog box tab. Make the following changes:
  - a. Select **Meas 1** and make sure the **Source1** button is selected.
  - b. In the Source tab, select **C1 on Main** and click the **Pulse** button.
  - c. Choose measurement **Select Meas > Pulse – Amplitude > Amplitude**.
  - d. Make sure the Meas 1 **ON** check box is selected.
  - e. Select **Meas 2** and make sure the **Source1** button is selected.
  - f. In the Source tab, select **C3 on Main** and click the **Pulse** button.
  - g. Choose measurement **Select Meas > Pulse – Timing > RMS Jitter**.
  - h. Make sure the Meas 1 **ON** check box is selected.
  - i. Verify that **Use Wfm Database** is selected.

**Test** Follow this procedure to make the clock recovery sensitivity and clock timing jitter checks:

1. In the Mode/Trigger dialog box, select the clock recovery rate for C1 that you want to test as shown in the following table.
2. Set the D3186 Pulse Pattern Generator to the rate setting and amplitude for the clock recovery rate that you selected in step 1 as shown in the following table.
3. Adjust the Horizontal SCALE knob on the front panel of the instrument to the setting listed in the table for the clock recovery rate that you selected in step 1 as shown in the following table.

**Table 1-13: Clock recovery settings**

Clock recovery rate	D3186		
	Rate setting	Amplitude	Horizontal Scale setting
OC-3	0.15552 Gb/s	1.0 V	1 ns/div
OC-12	0.62208 Gb/s	1.0 V	500 ps/div
FC-1063	1.0625 Gb/s	1.0 V	200 ps/div
GBE	1.25 Gb/s	1.0 V	200 ps/div

Table 1-13: Clock recovery settings (cont.)

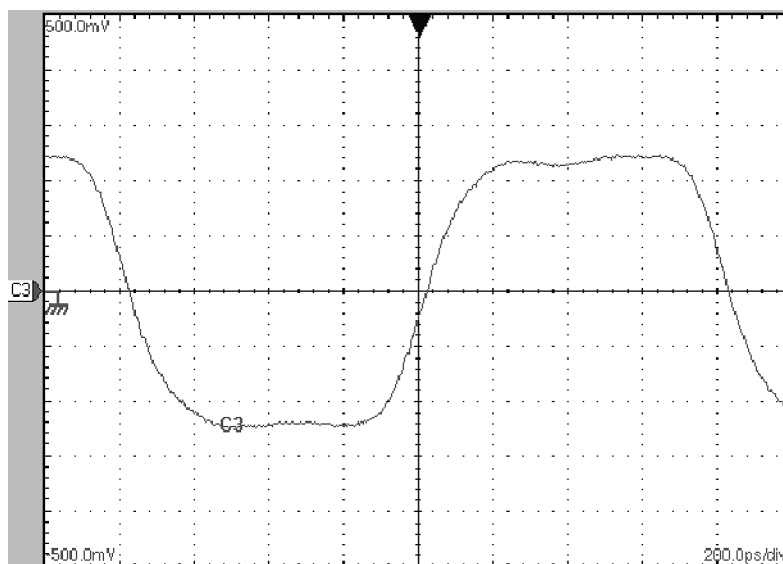
Clock recovery rate	D3186		
	Rate setting	Amplitude	Horizontal Scale setting
Serial ATA	1.50 Gb/s	1.0 V	200 ps/div
FC2125	2.125 Gb/s	1.0 V	100 ps/div
OC-48	2.48832 Gb/s	1.0 V	100 ps/div
2GBE	2.5 Gb/s	1.0 V	100 ps/div
Infiniband	2.5 Gb/s	1.0 V	100 ps/div
PCI Express	2.5 Gb/s	1.0 V	100 ps/div
2.5 G G.709 FEC	2.666 Gb/s	1.0 V	100 ps/div
Serial ATA	3.0 Gb/s	1.5 V	100 ps/div
XAUI	3.125 Gb/s	1.5 V	100 ps/div
FibreChannel	3.188 Gb/s	1.5 V	100 ps/div
VSR5	3.318 Gb/s	1.5 V	100 ps/div
4 Gigabit FibreChannel	4.25 Gb/s	1.5 V	100 ps/div
Serial ATA <sup>1</sup>	6.0 Gb/s	1.5 V	200 ps/div
XAUI <sup>1</sup>	6.25 Gb/s	1.5 V	100 ps/div
OC-192 <sup>1</sup>	9.95328 Gb/s	1.5 V	50 ps/div
10GBASE-W <sup>1</sup>	9.95328 Gb/s	1.5 V	50 ps/div
10GBASE-R <sup>1</sup>	10.3125 Gb/s	1.5 V	50 ps/div
10GFC <sup>1</sup>	10.51875 Gb/s	1.5 V	50 ps/div
G.975 FEC <sup>1</sup>	10.66 Gb/s	1.5 V	50 ps/div
G.709 FEC <sup>1</sup>	10.71 Gb/s	1.5 V	50 ps/div
10GbE w/FEC <sup>1</sup>	11.10 Gb/s	1.5 V	50 ps/div
Super FEC <sup>1</sup>	12.50 Gb/s	2.0 V	50 ps/div

<sup>1</sup> Only available with Option 10G.

At this point in the procedure, the instrument is triggered from the 1/32 clock from the D3186 Pulse Pattern Generator. The clock signal from the 80A05 Module that is connected to C3 on the 80E02 Sampling Module should be synchronous with the signal from the pulse pattern generator as shown in the following figure.

If the signals are not synchronous, check that the D3186 data rate is set to a data rate that matches the clock recovery rate set for the 80A05 Module. (See Table 1-13.)





**Figure 1-40: Display example (clock signal synchronized with the data rate input)**

4. Check that the Minimum amplitude measurement for C3 is greater than or equal to the value given in the Minimum amplitude column of the following table.
5. Do the following substeps to check recovered clock timing jitter:
  - a. Remove the two 10X attenuators from the 80A05 module and reconnect the 50  $\Omega$  coaxial cable from the pattern generator to the 80A05.
  - b. Set the D3186 Pulse Pattern Generator amplitude to **0.50 V**.
  - c. Zoom into the 50% crossing point of the first rising edge on the C3 clock signal until the Horizontal SCALE is **20 ps/div** and the Vertical SCALE is **10 mV/div**. (See Figure 1-41.)

---

**NOTE.** You can most easily zoom in on the 50% crossing point by click dragging a rectangle around this edge (using the mouse), and then using the SCALE and FINE control knobs to adjust the settings to 10 mV/div and 20 ps/div.

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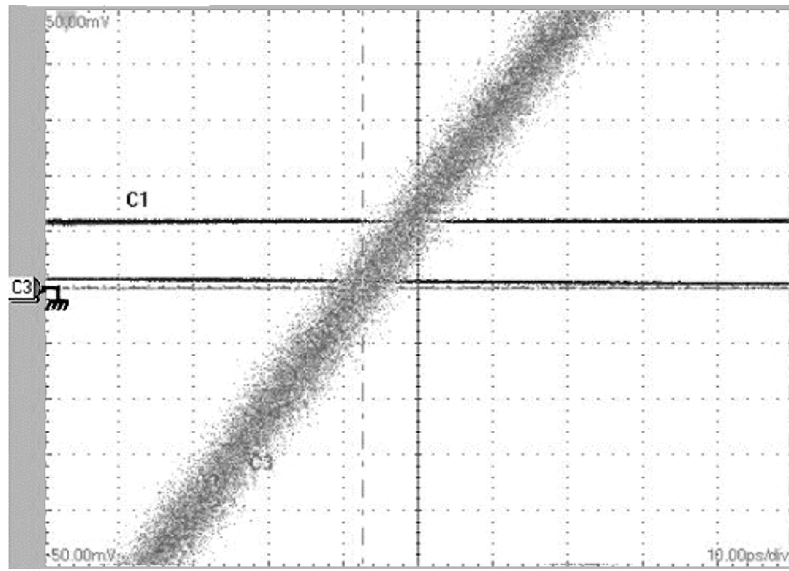
- d. Check that the RMS jitter measurement for C3 is less than or equal to the value given in the maximum RMS jitter column of the following table.
6. Repeat this procedure from step 1 to check the recovered clock sensitivity and recovered clock timing jitter for each of the clock recovery rates.

**Table 1-14: Clock recovery amplitude and jitter limits**

<b>Clock recovery rate</b>	<b>Minimum pk-pk amplitude</b>	<b>Max RMS jitter</b>
OC-3	>200 mV	64 ps
OC-12	>200 mV	16 ps
FC-1063	>200 mV	9.4 ps
GBE	>200 mV	8 ps
Serial ATA (1.50 Gb/s)	>200 mV	6.7 ps
FC2125	>200 mV	4.7 ps
OC-48	>200 mV	4 ps
2GBE	>200 mV	4 ps
Infiniband	>200 mV	4 ps
PCI Express	>200 mV	4 ps
2.5 G G.709 FEC	>200 mV	4 ps
Serial ATA (3.00 Gb/s)	>200 mV	2.5 ps
XAUI (3.125 Gb/s)	>200 mV	2.5 ps
FibreChannel	>200 mV	2.5 ps
VSR5	>200 mV	2.5 ps
4 Gigabit FibreChannel	>200 mV	2.5 ps
Serial ATA (6.00 Gb/s) <sup>1</sup>	>200 mV	2 ps
XAUI (6.25 Gb/s) <sup>1</sup>	>200 mV	2 ps
OC-192 <sup>1</sup>	>200 mV	2 ps
10GBASE-W <sup>1</sup>	>200 mV	2 ps
10GBASE-R <sup>1</sup>	>200 mV	2 ps
10GFC <sup>1</sup>	>200 mV	2 ps
G.975 FEC <sup>1</sup>	>200 mV	2 ps
G.709 FEC <sup>1</sup>	>200 mV	2 ps
10GbE w/FEC <sup>1</sup>	>200 mV	2 ps
Super FEC <sup>1</sup>	>200 mV	2 ps

<sup>1</sup> Only available with Option 10G.

7. Move the test setup from the 80A05 ELECTRICAL INPUT **IN+** connector to the **IN-** connector and repeat this procedure from step 1.



**Figure 1-41: Display example (zoomed in at the crossing point)**

**8.** Disconnect the test setup.

*End of Procedure*

*End of Document*