Agilent OmniBER OTN Family

OmniBER OTN
communications
performance analyzer

Verification Manual

Agilent Technologies

Agilent OmniBER Family
OmniBER OTN

J7230B & J7232A Models

Verification Manual

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Notices

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In This Manual...

You will find information for verifying the performance of your instrument

1 Performance Tests

This chapter details the procedures to test the performance of the instrument and provides a test record table to record the results of the tests. Part of the Performance Test is to run specific Self Tests.

2 Self Test Overview

This chapter details all of the self test procedures.

Conventions Used in this Manual

The conventions used in this manual to illustrate instrument keys and display information are as follows:

<Menu> This is an example of a hardkey. Hardkeys (located to the right of the display) are used to give access to different sets of instrument settings, or select dedicated instrument functions.

Menu Items Menu items appear in text in **bold** with the greater than (>) symbol separating each menu level. For example, if you are instructed to choose Errors and Alarms from the Test Functions menu, it appears as **Test Functions > Errors and Alarms**.

Field Items Field items you can select will appear in **bold**, for example select **Signal Rate** field.

Drop Down Lists The item you must select from a drop down list is also shown in bold. For example, select **Signal Rate** field and choose **STM-1** or **OC-3** from the drop down list.

Contents

1
Performance Tests

Introduction

The procedures given in this section test the performance of the Agilent J7230B or J7232A OmniBER OTN models using the instrument specifications for test accuracy limits. The tests are intended to be performed in the recommended order for a full instrument calibration check. Tests can be run individually, however it will be assumed that any preceding test would meet specifications.

Equipment Required

Equipment required for the performance tests is given in “Recommended Test Equipment" on page 9. Any equipment which meets or exceeds the critical specification of the equipment listed may be substituted. Recommended models are those typically used in Agilent Service Centers. Where appropriate, alternative models are also listed.

Performance Test Record

The results of the performance tests may be recorded in the “Performance Test Record" on page 88. The performance test record lists all the tested specifications and the acceptable limits. The results recorded at incoming inspection may be used for comparison during periodic maintenance, troubleshooting or after repair or adjustment.

Calibration Check Cycle

This instrument requires periodic verification of performance. Depending on use and environmental conditions, the instrument should be checked at least once every 2 years, using these performance tests.

Instrument Option Configuration

Please refer to Chapter 1 and the instrument Specifications for information on option configuration.

Recommended Test Equipment

Instrument	Critical Specification	Recommended Model
High Speed Optical Oscilloscope	Oscilloscope Mainframe 3 GHz Opt/Elect Module with STM-1/4 Filter 20 GHz Opt/Elect Module with STM-16/64 Filter.	86100A 86103A option 201 86105A option 202
Frequency Counter	Range 0 to 200 MHz, accuracy <0.1 ppm.	53181A option 001 or 5325A option 010
Optical Power Meter and Sensor Module	Range -8 dBm to -33 dBm, Wavelength1260 - 1600 nm	8163A and 81633A or 8153A and 81536A
Optical Attenuator	Wavelength 1200 - 1600 nm, Range 0 - 30 dB	8156A option 100 or 8157A
FC/PC Optical Interface Connector	Unique	81000FI (Qty 4)
Optical Cables	Unique	1005-0337 (Qty 2)
PDH/DSn Structured Test Set	Unique	OmniBER 718, with option 012 or OmniBER 719 with option 013
*Oscilloscope with Communications Mask Kit	>400 MHz BW communications mask measurement kit with appropriate connectors/adaptors. Capability DS1 to STS-3/STM-1e	54830B/54845B/54810A with option 100 (option 100 provides E2625A Communications Mask test kit)
*Termination Adaptor Probe	Balanced 110/120 ohms to unbalanced 50 ohms	E2621A (part of E2625A)
Adaptor	75/50 ohms unbalanced	E2622A (part of E2625A)
Patch Cable	Bantam 110 ohms	15670A
75Ω Termination	0 to 200 MHz	15522-80010
Balanced/Unbalanced Converter	110Ω balanced: 75Ω Unbalanced (nominal)	15508B

NOTE * Equipment is only required for opt 012 - PDH/DSn Interfaces.

Self Test Loopback Cables and Accessories

- 1005-0337 1m fiber optic patchcord FC/PC connectors.
- 1005-1148 10 dB optical attenuator FC/PC.
- 1005-0433 15 dB optical attenuator FC/PC.
- 15525A 75 ohm BNC cable, 2 off.
- 15670A Bantam 110 ohm cable, 2 off.
- J2125-65011 DCC port 9-pin loopback plug.

Recall Default Settings

The performance tests require the OmniBER OTN to be set to a pre-defined (default) state at the beginning of each test.

1. Press **<Menu>**, choose **System > Stored Settings** then press **<Select>**.
2. Select **Default** then **Recall.**
3. Select **OK,** then wait a few seconds for instrument to reconfigure to the default settings. Recall has completed when the dialog box clears.
4. Select **Close** on the Tx/Rx - Stored Settings window.

Performance Self Test

Part of the instrument self test is used for the performance tests. This provides a high degree of confidence that the relevant measurement hardware is operating correctly in advance of completing the performance tests.

NOTE A full overview of the self test is given later in the manual.

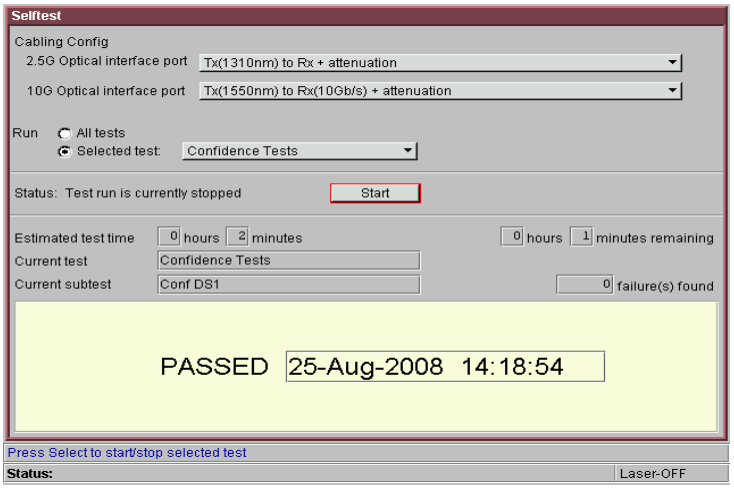
This section gives an description of the self tests that are required to be completed as part of the performance tests and covers the following

- Description of the self tests.
- Loopback connections required for self test
- How to run the self test.
- What to do if the self test fails.

Description of the Performance Self Test

The self test comprises of a selection of tests covering different areas of hardware in the instrument. For the purposes of the performance self tests, the **Confidence Test** and the **Frequency Measurement Test** should be completed. These are selected from the main self test menu. If a failure occurs during a test then a descriptive text message and Fail Code is returned.

Press **<Menu>**, choose **System > Self Test** then press **<Select>**. This opens the self test page. An example is shown below.



Loopback Connections Required for Self Test

The confidence test verifies all the optical and electrical (instruments with Option 012 only) test ports on the unit therefore loopback connections are required on the instrument. The following loopback connections are required (see Figure 1 on page 14).

Optical Loopback Connections (Option Dependent)

Use optical cables P/N 1005-0337 a 10 dB attenuator P/N 1005-1148 and 15 dB attenuator P/N 1005-0433.

- Connect 9.95/10.71 Gb/s Optical Out <> 10 dB Attenuator <> 9.95/10.71 Gb/s Optical In
- Connect 52 Mb/s-2.5 Gb/s Optical Out <> 15 dB Attenuator <> 2.5 Gb/s Optical In

Electrical connections SONET/SDH 52 Mb/s to 155 Mb/s

(Instruments with Option 012 only)

Use BNC cable P/N 15525A

- Connect SONET/SDH Out (BNC) <> SONET/SDH In (BNC)

Unbalanced Electrical Connections PDH/DSn 2-140 Mb/s and DS3 (Instruments with Option 012 only)

Use BNC cable P/N 15525A

- Connect 2-140 Mb/s DS3 Out (BNC) <> 2-140 Mb/s DS3 In (BNC)

Balanced Electrical Connections 2M/DS1 (Instruments with Option 012 only.)

Use Bantam cable P/N 15670A

- Connect 2M/DS1 Out <> 2M/DS1 In

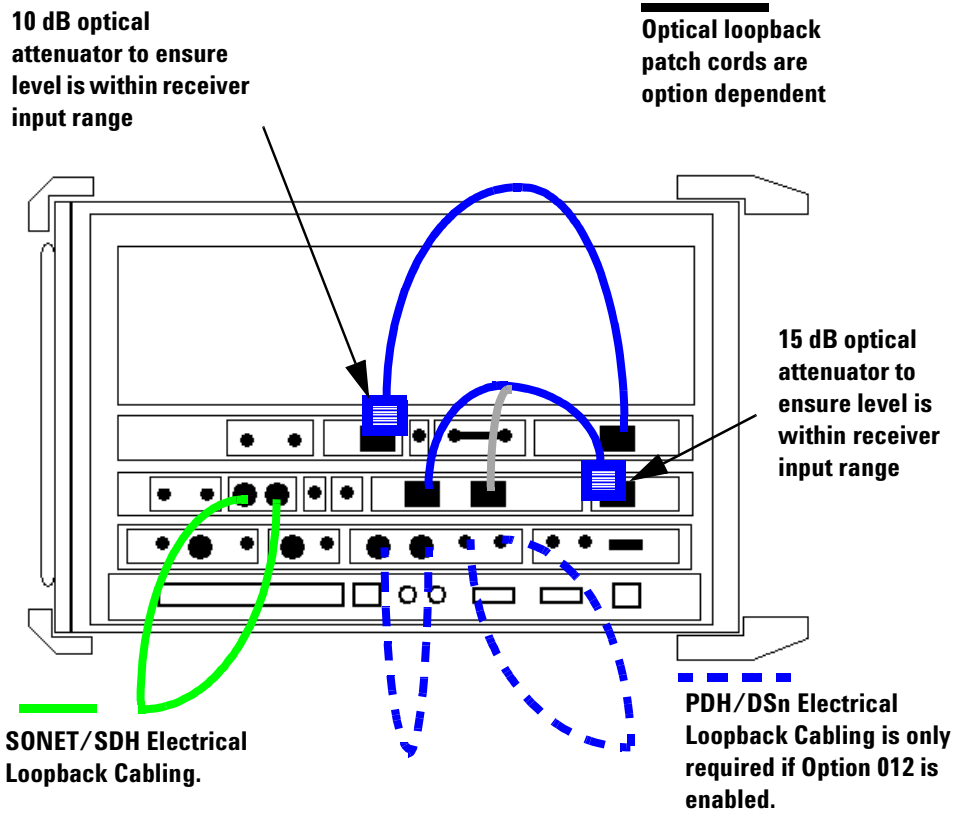


Figure 1 Self Test Loopback Connections

NOTE Where dual wavelength optical transmitters fitted the self test should be re-cabled and re-run to verify the alternative transmitters wavelength output. Select the cable configuration from the self test menu as appropriate.

CAUTION Safety precautions care and connection cleanliness must be observed to ensure that the optical connections are not damaged or degraded. Ensure the recommended optical attenuation is present in all optical loopback connections as failure to do so could cause self test failure or damage to the optical receivers.

How to run the Self Test

1. Press **<Menu>**, choose **System > Self Test** then press **<Select>**.
2. Ensure all loopbacks are in place and, from the self test page menu, select the appropriate 1310/1550 nm 2.5 G - 52 M optical loopback Cabling Configuration.
3. On the self test page choose **Run Selected Test** and choose **Confidence Test**. Choose START to begin the test.
4. The self test will now run selecting each sub-test in sequence. The remaining test time to complete the tests is displayed on the right hand side of the self test page.
5. If any sub-test fails an error message and error code will be returned. Up to five errors are recorded.
6. On the self test page choose **Run Selected Test** and choose **Frequency Measurement**. Choose START to begin the test.

Further information on the self test can be obtained in the self test overview section at the rear of this manual.

What to do if the Self Test fails

1. Check all connections to make sure that all the correct loopback connections are in place.
2. Be suspicious of any optical interface failures and if necessary clean all optical connections with a recognized cleaning kit before retrying the self test.
3. If the problem persists then contact your local Agilent Service Office or representative.

Internal Reference Clock Accuracy

Specification

Clock Output	Frequency	Accuracy
2 MHz	2.048 MHz	±4.5 ppm
DS1 (BITS Clock)	1.544 MHz	±4.5 ppm

Accuracy of Transmitter Internal Clock:

- Settability ± 0.5 ppm
- Stability ± 3 ppm over temperature range
- Ageing ± 1 ppm/year

NOTE

The 2 MHz output is only available when SDH or En rate is selected on the Transmitter. The DS1 output is only available when SONET or T-Carrier rate is selected on the Transmitter.

BITS Clock is not a binary format signal. Signal is a Ternary All 1s DS-1 signal with ESF Framing, clocked at 1.544 MHz.

Description

The test uses a Frequency Counter or DSn test set connected to the appropriate Clock output port. When the Transmitter is set to Internal Clock the reference output is derived from the instrument internal 10 MHz reference which is also used in main signal generation.

An alternative test method using the Frequency Counter is provided for the DS1 check if a suitable DSn test set is not available. However, in this case it should be noted that as this signal is a Framed All 1s Ternary signal the expected result on the Frequency Counter is offset due to the effect of Framing Bits in the signal.

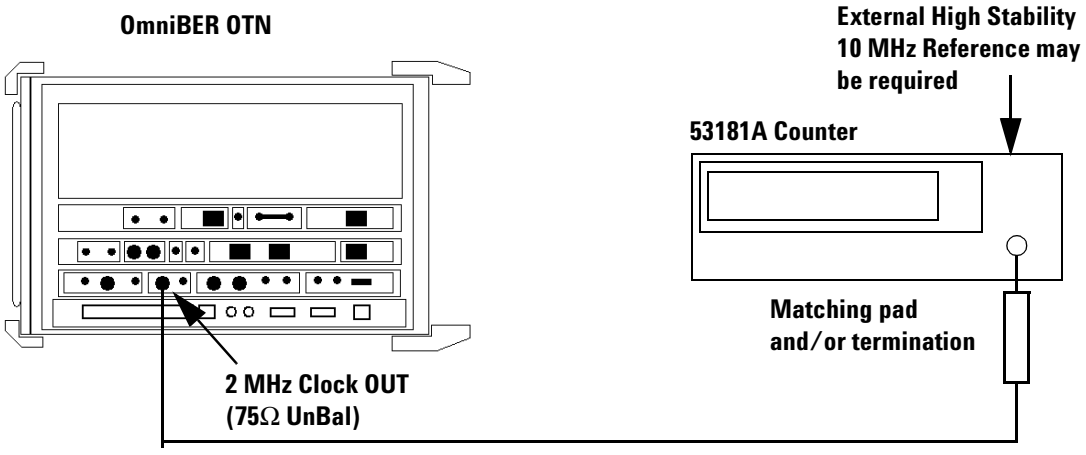
Equipment Required

Frequency Counter	Agilent 53181A Option 010,015 (see Note)
DSn Test Set	Agilent 37718C with Option 012
Bantam/Bantam Cable	Agilent 15670A
75/50 ohm Matching Pad	Agilent E2629A
Bal/Unbal Converter	Agilent 15508B

NOTE For accuracy required the counter MUST have high stability Internal Timebase option or be externally referenced to an in-house Standard.

Procedure

1. Press **<Menu>**, choose **System > Stored Settings** then press **<Select>**. Select **Default** then **Recall**.
2. Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SDH**.
3. Connect the OmniBER OTN's 2 MHz Clock Out port to the Frequency Counter Input using a 75/50Ω matching pad, set the input impedance to 50Ω. Alternatively, a 75Ω termination can be used with the input impedance set to 1MΩ.



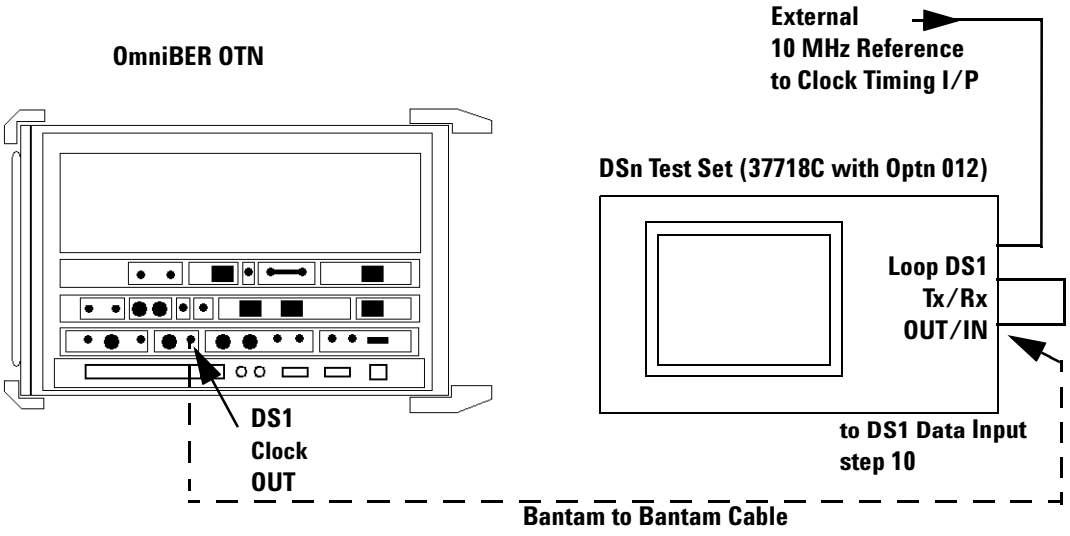
4 Adjust the frequency counter trigger level to obtain a stable reading and check that the frequency counter reads between:

2.0479908 MHz and 2.0480092 MHz.

NOTE The reading should be well within these limits. However, after several years of operation the main reference oscillator may need adjustment optimized to compensate for drift/ageing. If necessary contact your local Agilent Service for advice. Before doing so ensure the Counter being used has the appropriate internal/external reference accuracy.

5 Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SONET**.

6 Connect the DS1 Transmit OUT to Receive IN ports of the test set using a Bantam to Bantam cable. Also connect an external 10 MHz Reference signal to the test set 10M CLOCK input port.



7 Setup the test set settings as follows:

Tx/Rx to COUPLED mode.

SIGNAL to DS1 rate

PAYLOAD TYPE to ESF UNSTRUCTURED

PATTERN to ALL ONES

Set the Transmitter CLOCK to EXTERNAL 10 MHz REF

NOTE This ensures the test set transmitter generates a DS1 signal locked to the external 10 MHz reference signal, e.g. in-house standard. The signal is looped to the test set receiver to take note of the receiver frequency measurement accuracy/error.

8 Check there are no errors or alarms indicated by the test set receiver.

NOTE If the test set CLOCK LOSS LED is ON check the external reference signal.

9 Set the test set to display the frequency measurement and ppm offset results and check these are between:

1543993 and 1544007 Hz.

–4.5 and +4.5 ppm

10 Change the test setup as follows. Disconnect the loopback connection between test set Tx/Rx then connect the OmniBER OTN DS1 clock out port to the test set DS1 receive port using the Bantam to Bantam cable.

11 Check there are no errors or alarms indicated by the test set receiver.

12 Set the test set to display the frequency offset measurement result and check this is between:

–9 ppm and +9 ppm

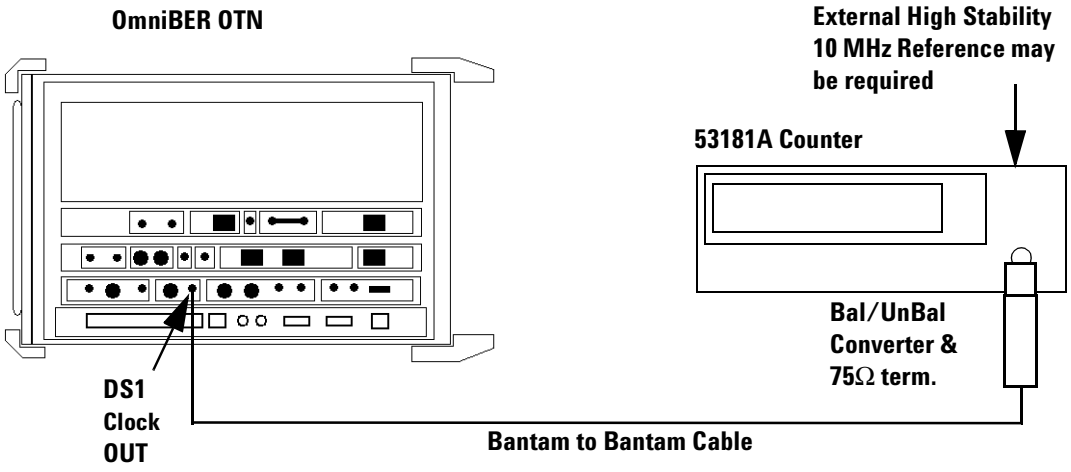
13 Subtract the ppm test set error noted in step 9 from the result in step 12 to give the OmniBER OTN transmitter DS1 Bits frequency error in ppm and check this is between:

–4.5 ppm and +4.5 ppm

14 Test is now complete.

Alternative DS1 Clock test (if suitable DSn Test Set is not available)

1 Connect the OmniBER OTN's DS1 Clock Out port to the Frequency Counter Input using a 110/75Ω Bal/Unbal Converter and 75Ω termination. Set the Frequency Counter input impedance set to 1MΩ.



NOTE

As the DS1 Clock Output is a Framed All '1's signal the average frequency measured by the Counter will be less than expected, e.g. 1541000 Hz rather than 1544000 Hz due to the effects of Framing Bits in the signal. The Ternary format of the signal can also mean that depending on input attenuation/trigger setting the counter may trigger on exactly half the signal rate e.g. 770500 Hz.

2 Adjust the Frequency Counter Trigger Level to obtain a stable reading and it will also be necessary to increase the Gating time due to the effects of Framing Bits. Check that the Frequency Counter reads between:

1.540993 MHz and 1.541007 MHz

3 Alternative Test Complete.

External Clock Reference Inputs and Clock Reference Output

Specifications

Clock Rate	Description
2.048 Mb/s MTS	Accepts timing reference as per ITU-T G.703-1998
2.048 MHz Clock	Accepts timing reference as per ITU-T G.703-1998
1.544 Mb/s BITS	Accepts DS-1 timing reference as per TA-TSY-000378

NOTE

The 2 MHz input is only available when SDH or En rate is selected on the Transmitter. The DS1 input is only available when SONET or T-Carrier rate is selected on the Transmitter.

BITS Clock is not a binary format signal. Signal is a Ternary All 1's DS-1 signal with ESF Framing, clocked at 1.544 MHz.

Description

The test uses a PDH/DSn test set and a Frequency Counter connected to the appropriate external Clock input and output ports. When the Transmitter is set to external Clock the reference Clock output port timing and signal rate generation is derived from the external Clock source.

Equipment Required

Frequency Counter	Agilent 53181A Option 010,015 (see Note)
DSn Test Set	Agilent 37718C with Option 012
Bantam/Bantam Cables (2)	Agilent 15670A
75/50 ohm Matching Pad	Agilent E2629A
Bal/Unbal Converter	Agilent 15508B

NOTE For accuracy required the counter MUST have high stability Internal Timebase option or be externally referenced to an in-house Standard.

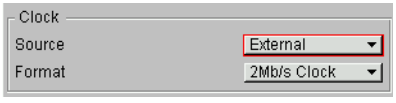
Procedure

(External 2M Clock as Reference)

1 Press **<Menu>**, choose **System > Stored Settings** then press **<Select>**. Select **Default** the **Recall**.

2 Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SDH.**

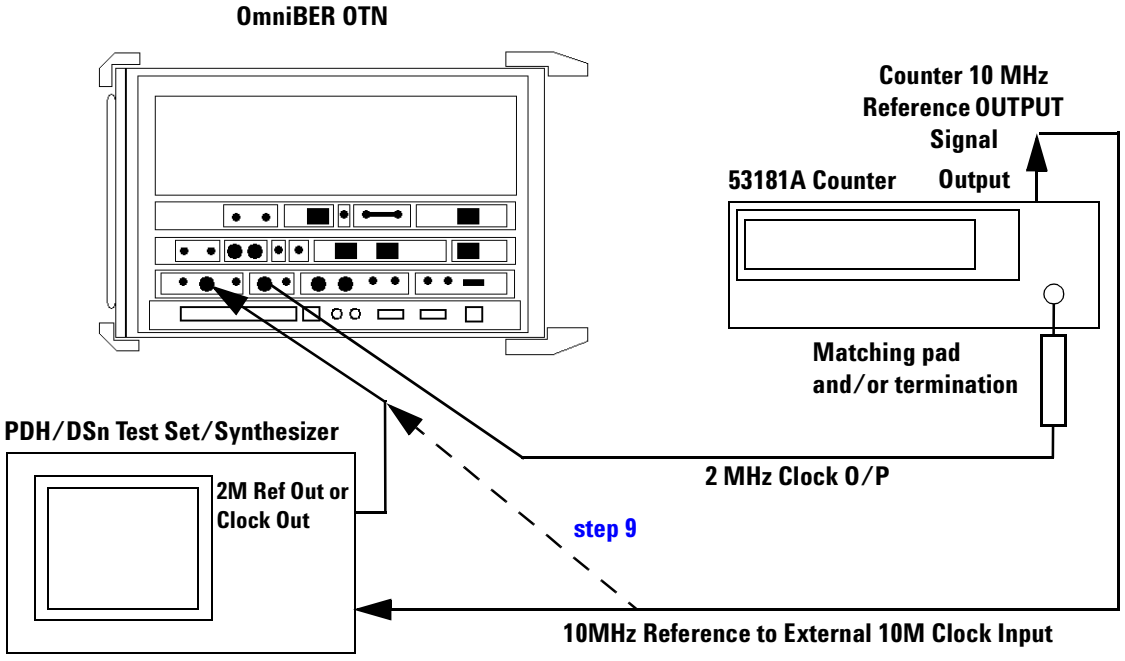
Now set **Clock Source** to **External**, **Format** to **2Mb/s Clock**.



3 Connect the OmniBER OTN's 2 MHz Clock Out port to the Frequency Counter Input using a 75/50Ω matching pad, set the input impedance to 50Ω. Alternatively, a 75Ω termination can be used with the input impedance set to 1MΩ.

Connect the Counter rear panel 10 MHz Reference Output to the PDH/DSn test set external 10M CLOCK input port.

Connect the PDH/DSn test set CLOCK REF OUT or TRANSMIT CLOCK OUT port to the instrument's CLOCK IN 2MHz BNC port.



4 Set the PDH/DSn test set transmitter as follows.

SIGNAL to 2 Mb/s rate

CLOCK to EXTERNAL 10 MHz REF

5 Check that the PDH/DSn test set CLOCK LOSS alarm LED is not lit.

6 Adjust the frequency counter trigger level to obtain a stable reading and check that the frequency counter reads between:

2.047999999 MHz and 2.048000001 MHz.

7 Confirm that the OmniBER OTN is locked to the external signal by disconnecting/re-connecting the BNC cable at the instrument CLOCK IN port

(External 10M Clock as Reference)

8 Now set the instrument to **External Clock, 10M Ref.**

9 Disconnect the 10M Reference signal from the PDH/DSn test set and connect it directly to the OmniBER OTN as shown in the diagram above.

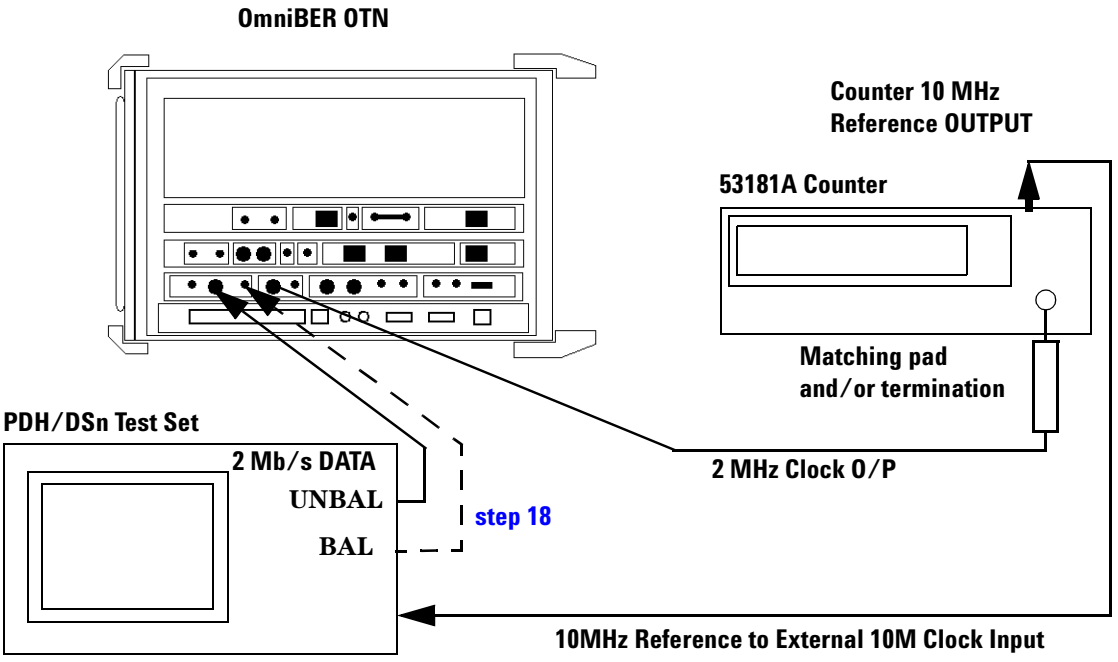
10 Repeat step 5 through step 7

(External 2M Unbalanced Data as Reference)

11 Re-connect as in the diagram below.

12 Change the OmniBER OTN **External Clock**, **Format** setting to **2 Mb/s Data**.

13 Change the 2 MHz CLOCK OUT connection at the PDH/DSn test set to connect the transmit 2 Mb/s DATA out BNC to the OmniBER OTN CLOCK IN BNC port.



14 Ensure the PDH/DSn test set transmitter is set as follows.

SIGNAL to 2 Mb/s rate

CLOCK to EXTERNAL 10 MHz REF

TERMINATION to 75 ohm UNBAL

LINE CODE to HDB3

PAYLOAD TYPE to UNFRAMED

PATTERN to 2^23 PRBS

15 Check that the test set CLOCK LOSS Alarm LED is not lit.

16 Adjust the frequency counter trigger level to obtain a stable reading and check that the frequency counter reads between:

2.047999999 MHz and 2.048000001 MHz

17 Confirm that the OmniBER OTN is locked to the external signal by disconnecting/re-connecting the BNC cable at the OmniBER OTN CLOCK IN port.

(External 2M Balanced Data as Reference)

18 Change the set-up as follows. Disconnect and remove the test set to OmniBER OTN (BNC to BNC) signal connection. Connect a Bantam to Bantam balanced cable between the test set data OUT port and OmniBER OTN CLOCK IN port. (A 3 pin Siemens to Bantam adapter/cable may be required depending on the test set's connector option)

19 Change the test set transmit TERMINATION to 120 ohm BALANCED.

20 Check that the test set CLOCK LOSS alarm LED is not lit.

21 Adjust the frequency counter trigger level to obtain a stable reading and check that the frequency counter reads between.

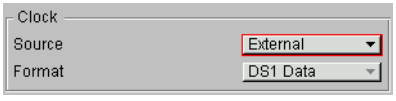
2.047999999 MHz and 2.048000001 MHz

22 Confirm that the OmniBER OTN is locked to the external signal by disconnecting/re-connecting the BNC cable at the OmniBER OTN CLOCK IN port.

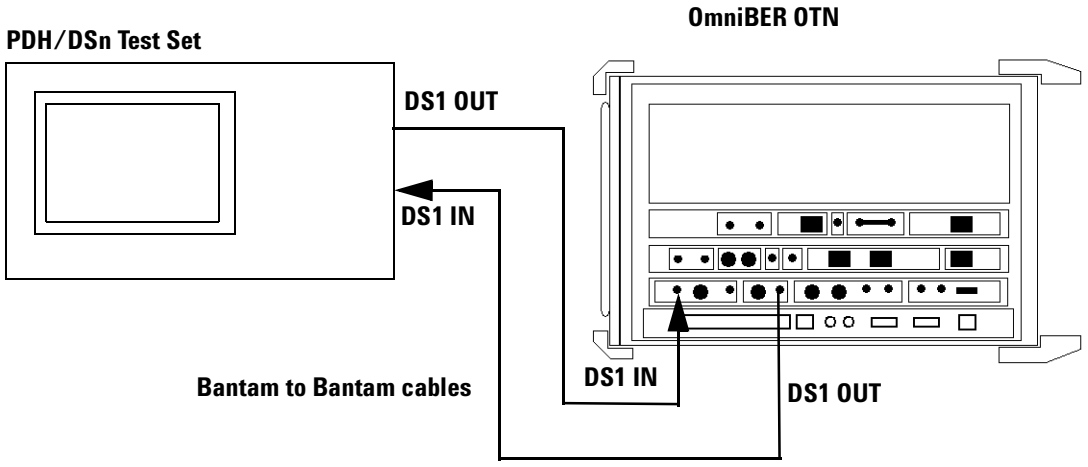
(External DS1 Balanced Data as Reference)

23 Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SONET.**

Now set **Clock Source** to **External**, **Format** to **DS1 Data**.



24 Connect the test set DS1 transmit OUT port to the OmniBER OTN Clock IN DS1 port using a Bantam cable. Connect the OmniBER OTN's DS1 clock out port to the test set DS1 receiver IN using a Bantam cable.



25 Set the PDH/DSn test set as follows:

TRANSMIT/RECEIVE settings to COUPLED

SIGNAL to DS1 rate

CLOCK to INTERNAL

OUTPUT LEVEL to DSX-1

LINE CODE to B8ZS

PAYLOAD TYPE to ESF UNSTRUCTURED

PATTERN to ALL ONES

26 Check there are no errors or alarms detected by the test set receiver

27 Set the test set to frequency measurement results and check that the displayed frequency is between:

1543999 Hz and 1544001Hz

28 Confirm that the OmniBER OTN is locked to the external signal by disconnecting/re-connecting the BNC cable at the OmniBER OTN CLOCK IN port.

29 Test is now complete.

Optical Pulse Mask and Output Characteristics

Specifications

Optical Output Power	
1310 nm 1550 nm (<=2.5 Gb/s) 1550 nm (9.95/10.71 Gb/s)	 -2.5 to +4 dBm * -1 to +2 dBm *
* Typical transmit power level is in the middle of the stated range.	
Extinction ratio	>8.2 dB
Pulse mask	Meets ITU-T G-957 (6/1999) and Telcordia GR-253-CORE Issue 3 (9/2000)

Description

This test ensures the optical transmitter(s) output power level and waveform meet the required eye mask, extinction ratio and average power specifications. The transmitter output is connected to an optical oscilloscope and the eye compared with the predefined masks stored in the oscilloscope memory. The average signal power levels and extinction ratio are also measured using the oscilloscope.

NOTE These tests are identical for SONET or SDH modes and can be tested in either mode and should not be repeated for both.

Equipment Required

High Speed Optical Oscilloscope	Agilent Infinium 86100A Mainframe Agilent Infinium 86103A option 201, Optical Plug-in Agilent Infinium 86105A option 202, Optical Plug-in
Optical Attenuator	Agilent 8156A
Optical Patch Cord(s)	Agilent PN 1005-0337
BNC(m) to SMA(f) Adapter	Agilent E9632A
SMA(m) to SMA(m) cable	Agilent PN 8120-4948

Procedure

NOTE

This performance test uses the Infinium 86100A Optical Oscilloscope (DCA) with appropriate optical plug-in modules and built-in filters. If a different oscilloscope is used refer to the oscilloscope information for optical eye mask measurement.

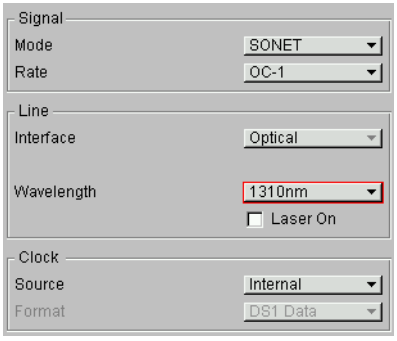
The OTU-2 pulse mask files may not be available on your oscilloscope. If required these can be obtained from the Agilent.com web site at http://www.agilent.com/cm/rdmfg/omniber/otn/library under the heading “Software and Drivers”

52/155 and 622 Mb/s Optical Output Checks

OC-1/STM-0 Power Level and Eye Mask Tests

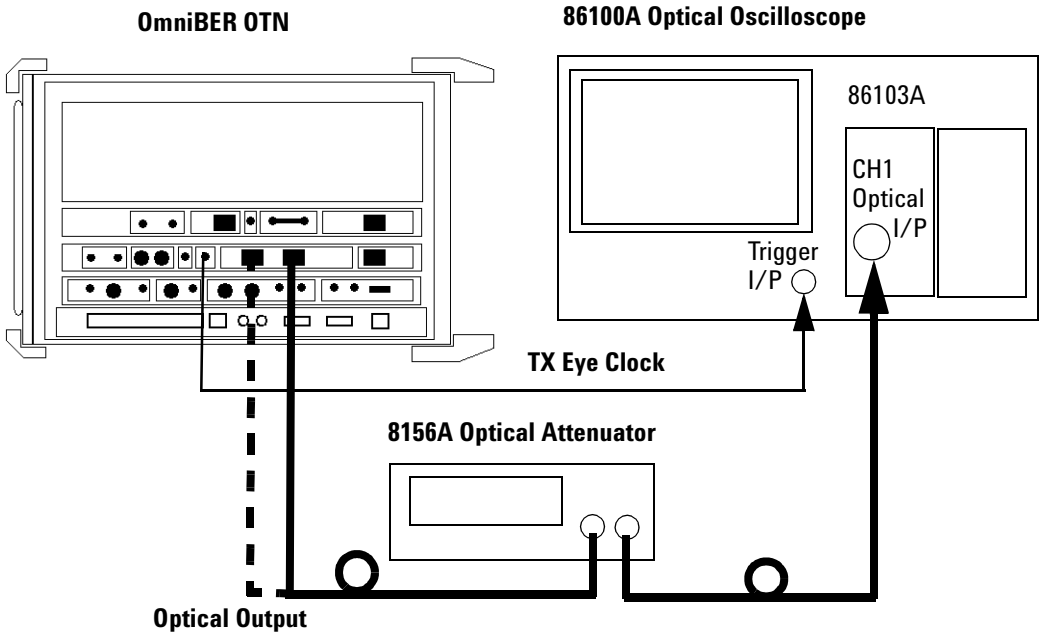
1 Press **<Menu>**, choose **System > Stored Settings** then press **<Select>**. Select **Default** then **Recall**.

2 Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SONET,** the **Signal Rate** to **OC1** and the **Wavelength 1310 nm** (or if this is not fitted, or already tested, select **1550 nm**). Ensure the **Laser** is set to **OFF**.



3 Connect the **52 Mb/s Optical Out** Port (1310/1550 nm) to the oscilloscope via an optical attenuator. Set the attenuator to provide approximately 6dB attenuation, (see Note). Also connect the **TX Eye Clock** (52 Mb/2.5 Gb/s) to the oscilloscope Trigger input.

NOTE Optical signal should be attenuated to ensure specified maximum input for 86103A (–4 dBm) is not exceeded. To ensure this, Set the 8156A to 3 dB, (typical 8156A attenuator insertion loss of approximately 3 dB), giving approximately 6 dB total attenuation.



4 Set OmniBER OTN **Laser** to **ON** and set optical attenuator to Enable.

5 On the oscilloscope select **Setup > Channel 1 > Advanced settings.** Switch oscilloscope Channel 1 ON, set it to the correct optical wavelength for the signal being tested and set **Mask Filter** to **OC-3 (156Mb/s), ON**, see Note.

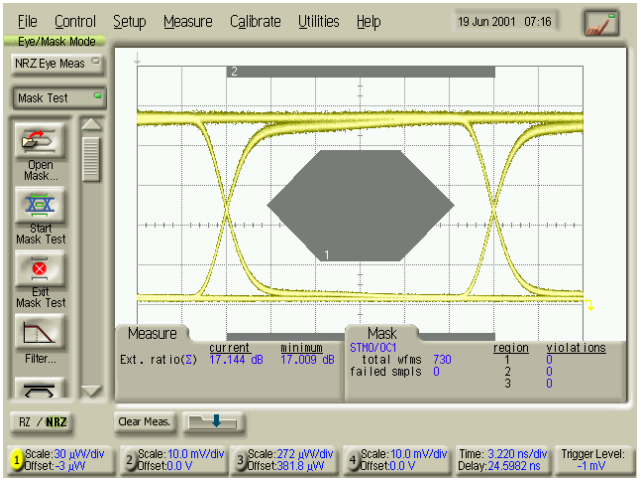
NOTE Normally an OC-1 filter would be used, however as this may not be available, it is permissible to use the OC-3 Filter for this check. The procedures for higher bit rates using OC-3, OC-12 and OC-48 filters will give confirmation that laser overshoot response is as expected.

6 Set all other oscilloscope channels off.

7 Select **Eye/Mask Mode**, **Mask Test.** Select **Open Mask** and open the **STM000_OC1.msk**.

8 Select oscilloscope **Autoscale** and allow the oscilloscope to find signal and trigger inputs.

9 Start **Mask Test** and check the optical output meets the mask. See example below.



OC-1/STM-0 Eye Mask

10 Set the oscilloscope to **Eye Measure** mode and select **Extinction Ratio** measurement.

NOTE

Ensure Vertical Calibration and Extinction Ratio Calibration have been performed for the oscilloscope channel and vertical sensitivity range to ensure measurement accuracy. Refer to oscilloscope information/Help if necessary.

11 Check the extinction ratio is greater than **8.2 dB** and record the measured value.

OC-3/STM-1 Power Level and Eye Mask Tests

12 Change the OmniBER OTN signal rate. Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Rate** to **OC3**.

13 Select **Eye/Mask Mode**, **Mask Test.** Select **Filter** and ensure it is set to **OC-3 (156Mb/s), ON**

14 Select **Open Mask** and open the **STM001_OC3.msk**.

15 Select oscilloscope **Autoscale** and allow the oscilloscope to find signal and trigger inputs.

16 Start **Mask Test** and check the optical output meets the mask. See example on page 37.

17 Set the oscilloscope to **Eye Measure** mode and select **Extinction Ratio** measurement.

18 Check the extinction ratio is greater than **8.2 dB** and record the measured value.

OC-12/STM-4 Power Level and Eye Mask Tests

19 Change the OmniBER OTN signal rate. Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Rate** to **OC12**.

20 Select **Eye/Mask Mode**, **Mask Test.** Select **Filter** and set it to **OC-12 (622Mb/s), ON**

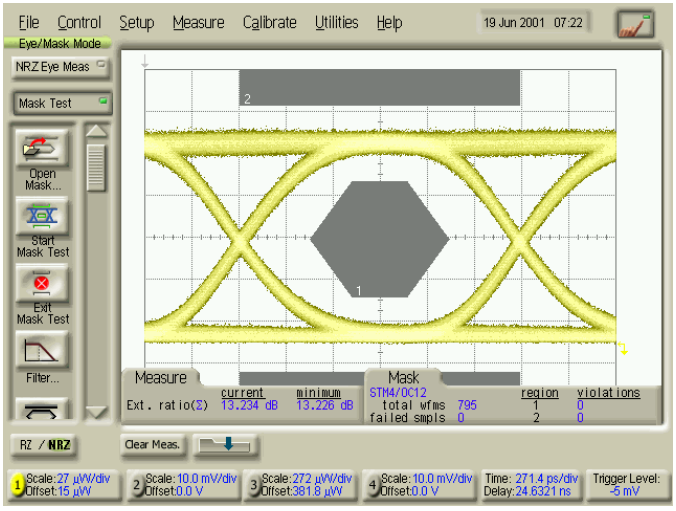
21 Select **Open Mask** and open the **STM004_OC12.msk**.

22 Select oscilloscope **Autoscale** and allow the oscilloscope to find signal and trigger inputs.

23 Start **Mask Test** and check the optical output meets the mask. See example on page 37.

24 Set the oscilloscope to **Eye Measure** mode and select **Extinction Ratio** measurement.

25 Check the extinction ratio is greater than **8.2 dB** and record the measured value.



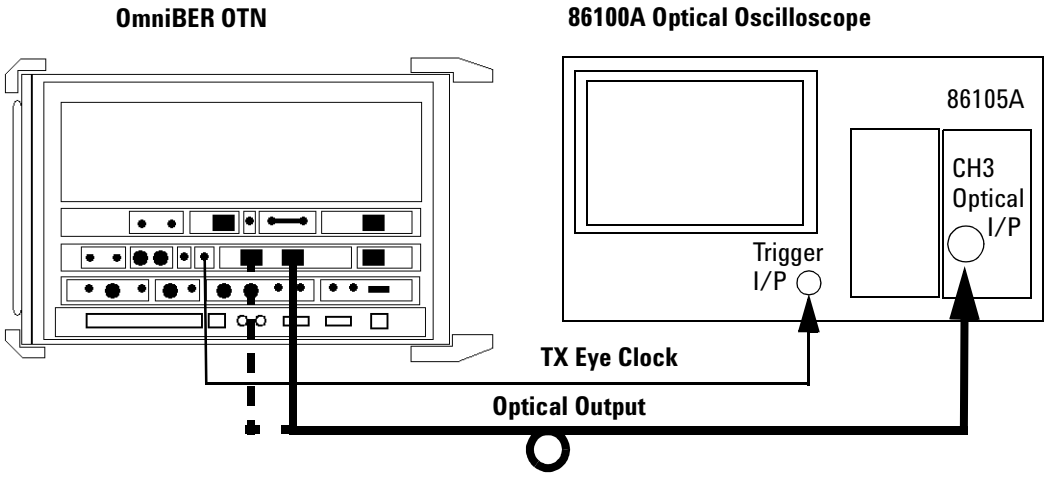
OC-12/STM-4 Eye Mask

2.5 Gb/s Optical Output Checks

OC-48/STM-16 Power Level and Eye Mask Tests

26 Change the OmniBER OTN Signal Rate. Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SONET** and the **Signal Rate** to **OC48**. Set **Laser** to **OFF**.

27 Remove the Attenuator from the Setup and connect the **2.5 Gb/s Optical Out Port** (1310/1550 nm) directly to the oscilloscope Channel 3 Input as shown on the next page.



28 Set the OmniBER OTN Laser to ON.

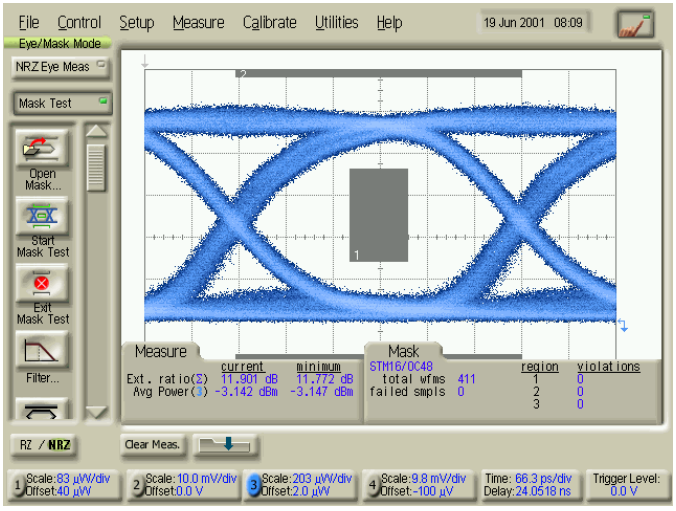
29 On the oscilloscope select **Setup > Channel 3 > Advanced settings.** Switch oscilloscope Channel 3 ON, set it to the correct optical wavelength for the signal being tested and set **Mask Filter** to **OC-48 (2.488Gb/s), ON**,

30 Set all other oscilloscope channels off.

31 Select **Eye/Mask Mode**, **Mask Test.** Select **Open Mask** and open the **STM016_OC48.msk**.

32 Select oscilloscope **Autoscale** and allow the oscilloscope to find signal and trigger inputs.

33 Start **Mask Test** and check the optical output meets the mask. See example on page 39.



OC-48/STM-16 Eye Mask

34 Set the oscilloscope to **Eye Measure** mode and setup to measure the **Average Power** (in dBm) and **Extinction Ratio.**

NOTE

Ensure Vertical Calibration and Extinction Ratio Calibration have been performed for the oscilloscope channel and vertical sensitivity range to ensure measurement accuracy. Refer to oscilloscope information/Help if necessary

35 Check the average optical power is between:

–2.5 dBm to +4 dBm

36 Check the extinction ratio is greater than **8.2 dB** and record the measured value.

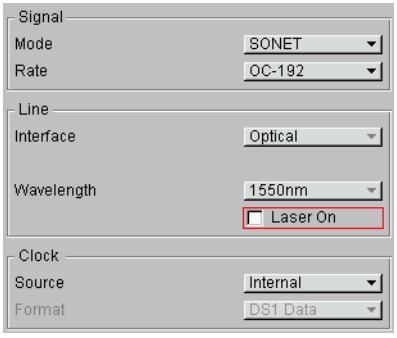
37 If the instrument has dual wavelength option (1310 and 1550 nm ports) for 51 - 2.5 Gb/s, repeat step 1 through step 37 for the 1550 nm output and use 1550 nm settings as appropriate for oscilloscope channel inputs.

9.95 Gb/s and 10.71 Gb/s Optical Output Checks (J7230B and J7232A Opt 108 Only)

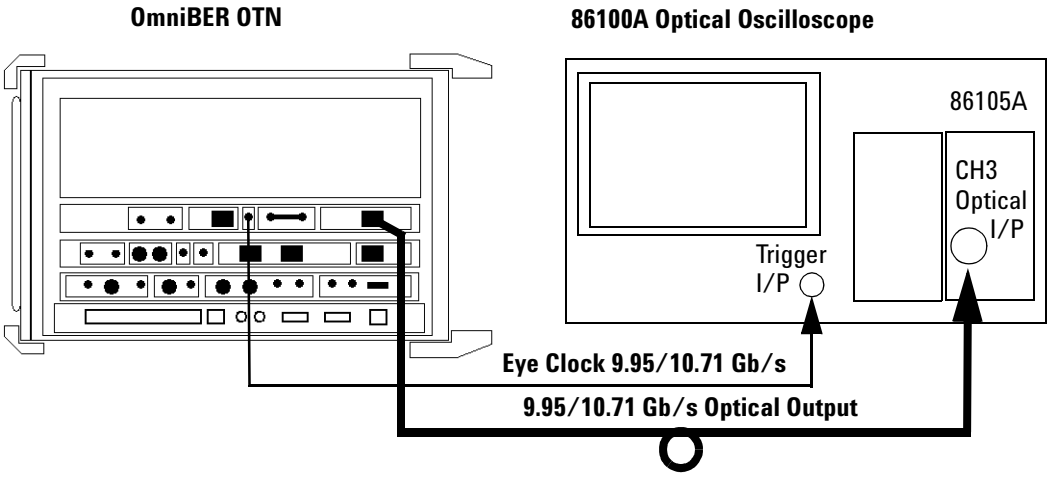
OC-192/STM-64 Power Level and Eye Mask Tests

1 Press **<Menu>**, choose **System > Stored Settings** then press **<Select>**. Select **Default** then **Recall**.

2 Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SONET** and **Signal Rate** to **OC192**. Ensure the **Laser** is set to **OFF**.



3 Connect the **9.95/10.71 Gb/s Optical Out** port to the oscilloscope using an Optical Patch cord. Also connect the connect the **TX Eye Clock** (9.95/10.71 Gb/s) to the oscilloscope Trigger input as shown.



4 Set the OmniBER OTN **Laser** to **ON**.

5 On the oscilloscope select **Setup > Channel 3 > Advanced settings.** Set it to the correct optical wavelength for the signal being tested and set **Mask Filter** to **OC-192 (9.95Gb/s), ON**,

6 Select **Eye/Mask Mode**, **Mask Test.** Select **Open Mask** and open the **STM064_OC192.msk**.

7 Select oscilloscope **Autoscale** and allow the oscilloscope to find signal and trigger inputs.

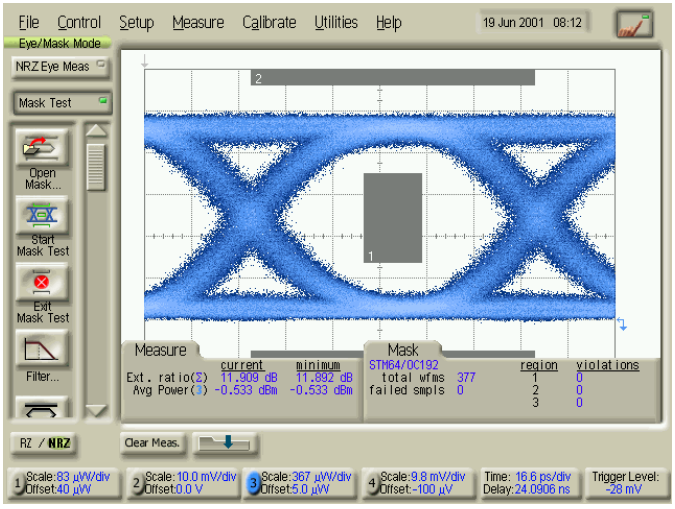
8 Start **Mask Test** and check the optical output meets the "OC-192/STM-64 Eye Mask" on page 42

9 Set the oscilloscope to **Eye Measure** mode and setup to measure the **Average Power** (in dBm) and **Extinction Ratio**.

NOTE Ensure Vertical Calibration and Extinction Ratio Calibration have been performed for the oscilloscope channel and vertical sensitivity range to ensure measurement accuracy. Refer to oscilloscope information/Help if necessary.

10 Check the average optical power is between **–1 to +2 dBm**.

11 Check the Extinction Ratio is greater than **8.2 dB** and record the measured value.

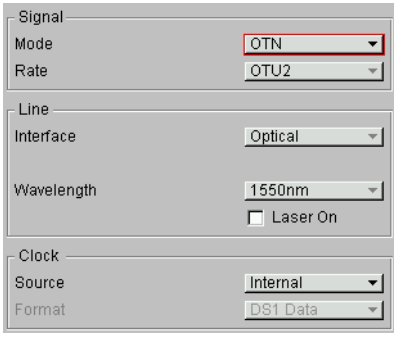


OC-192/STM-64 Eye Mask

10.71 Gb/s (OTU-2) Power Level and Eye Mask Tests (Option 112 only)

12 Set the Transmitter display as shown below.

Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **OTN** and the **Signal Rate** to **OTU-2**.



13 Ensure the OmniBER OTN **Laser** is **ON**.

14 Select **Eye/Mask Mode**, **Mask Test.** Select **Filter** and ensure it is set to **OC-192 (9.95Gb/s), ON**

15 Change the mask to OTU-2.

16 Select oscilloscope **Autoscale** and allow the oscilloscope to find signal and trigger inputs

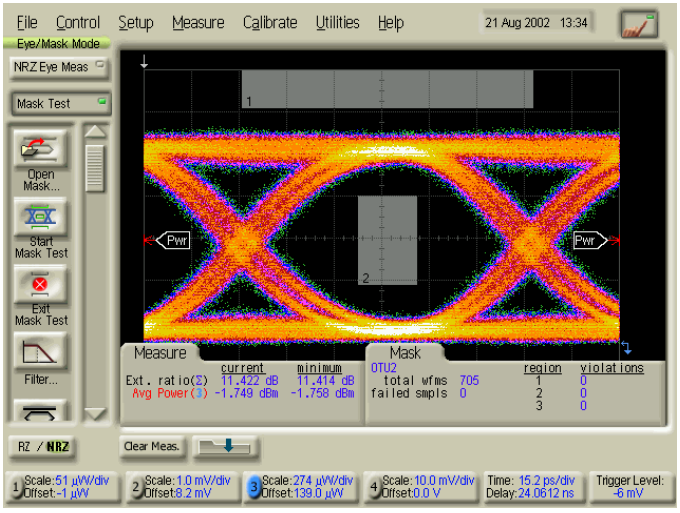
17 Start **Mask Test** and check the optical output meets the OTU-2 mask on page 44.

18 Set the oscilloscope to **Eye Measure** mode and set up to measure the **Average Power** (in dBm) and **Extinction Ratio**.

NOTE Ensure Vertical Calibration and Extinction Ratio Calibration have been performed for the oscilloscope channel and vertical sensitivity range to ensure measurement accuracy. Refer to oscilloscope information/Help if necessary.

19 Check the average optical power is between **–1 to +2 dBm**. Check the extinction ratio is greater than **8.2 dB** and record the measured value.

20 Tests are now complete. Set the laser to OFF before disconnecting setup.



OTU-2 Eye Mask

Optical Receiver Sensitivity, Optical Power and Frequency Measurement

Specifications

Min. sensitivity (1):	
52/155 Mb/s	–34 dBm
622 Mb/s	–28 dBm
2.5 Gb/s	–28 dBm
9.95 Gb/s	–18 dBm
10.71 Gb/s	–16 dBm
Max. input power (1):	
52/155 Mb/s	–10 dBm
622 Mb/s	–8 dBm
2.5 Gb/s	–9 dBm
9.95 Gb/s	–9 dBm
10.71 Gb/s	–9 dBm

1. For 52 Mb/s – 2.5 Gb/s the Min. sensitivity quoted is for BER = 1 x 10 –10 (input signal extinction ratio = 8.2 dB).
For 9.95 Gb/s & 10.71 Gb/s the Min. sensitivity quoted is for BER = 1 x 10 –12 (input signal extinction ratio = 8.2 dB).

Optical power measurement	Supported for all optical receive rates. **Ranges**: 10 Gb/s: –3dBm to –25 dBm. 2.5 Gb/s: 0 dBm to –28 dBm. 622 Mb/s and below: 0 dBm to –30 dBm. **Accuracy**: 10 Gb/s: ± 1.5 dB. 2.5 Gb/s: ± 2 dB. 622 Mb/s and below: ± 1 dB. **Resolution:** 0.1 dB.
Line frequency measurement	Supported for all optical and electrical receive rates. **Results**: Frequency (MHz), Offset (Hz and ppm). **Accuracy:** ± 4.5 ppm. **Resolution**: **Frequency:** 0.01 kHz (up to 622 Mb/s), 0.1 kHz.(2.5 Gb/s and 10 Gb/s). **Offset:** 0.1 ppm.

NOTE The rates and wavelengths available are dependent on the OmniBER OTN options fitted.

Description

The Transmitter output is attenuated and set for appropriate level using an external Power meter. The receiver sensitivity is verified using the attenuated transmitter output and checking for no errors in back-to-back mode. Checks of the receiver operation at operating max and min levels is performed. The receiver optical power and frequency measurements are also checked during these tests.

Sensitivity measurements are affected by the extinction ratio of the laser used in the test. Receiver sensitivity specifications are quoted for worst case, that is minimum laser extinction ratio specification. A table is provided at the end of these tests to check the typical additional receiver sensitivity expected against the extinction ratio of the laser used in test.

NOTE

- These tests are identical for SONET or SDH modes and can be tested in either mode and should not be repeated for both.
- Always set the laser to OFF before changing optical output port connections.
- It is most important that advice on optical cleanliness is adhered to ensure accuracy of these tests and to prevent damage to optical interfaces

Equipment Required

Power Meter	Agilent 8163A
Power Meter Sensor Module	Agilent 81633A
Optical Attenuator	Agilent 8156A
FC/PC Connector Interface (qty 4)	Agilent 81000FI
Optical Cables (qty 2)	Agilent PN 1005-0337

WARNING

Safety precautions must be observed when handling the OmniBER OTN's Optical Modules as these generate laser signals which can cause serious injury. The guidelines below must be followed:

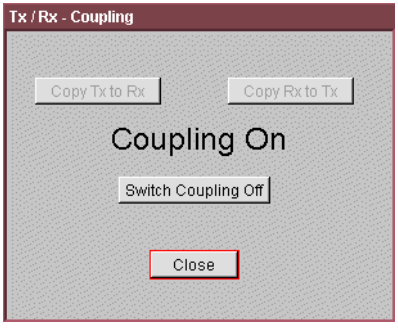
- Check the connector configuration of the Fiber Optic Interfaces. If non FC/PC connectors are fitted then remove them, then fit the FC/PC connector interface.
- Check for any damage to the OmniBER OTN's Fiber Optic Interface spring loaded aperture covers and connectors. Do not power up the instrument if in any doubt about the integrity of these connectors.

Procedure

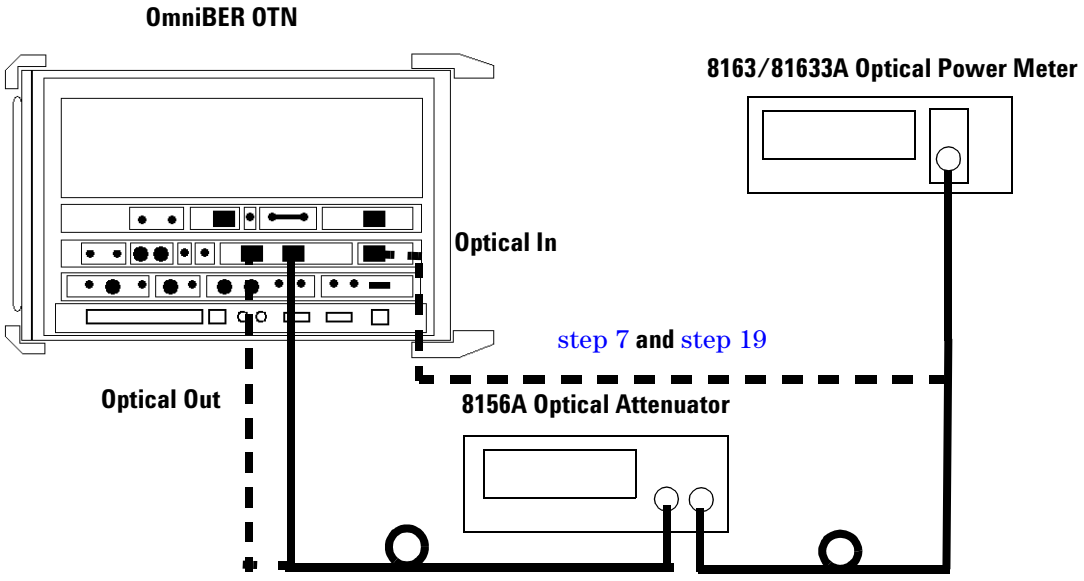
OC-1/STM-0 and OC-3/STM-1 Rates

1 Press **<Menu>**, choose **System > Stored Settings** then press **<Select>**. Select **Default** then **Recall**.

2 Press **<Menu>**, choose **Tx/Rx > Coupling** then press **<Select>**. Select **Copy Tx to Rx**.



3 Connect the test set-up as shown below depending on the wavelengths installed.



4 Set the optical attenuator to:

ATTEN 15 dB

WAVELENGTH 1310 nm (or 1550 nm depending on wavelength used)

CAL=0

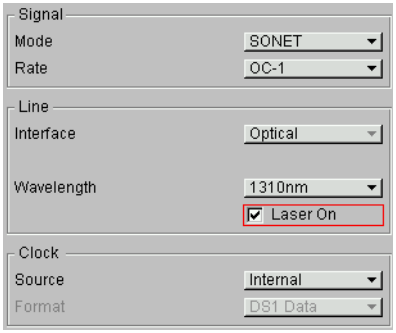
ENB ON

Set the optical power meter to:

WAVELENGTH 1310 nm (or 1550 nm depending on wavelength used)

Connect the optical attenuator between the power meter and the OmniBER OTN's **Optical Out** port (ensure that all connections are tight and that the cable has no twists).

5 Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SONET** and **Signal Rate** to **OC1**, **Wavelength 1310 nm** (or if this is not fitted, select **1550 nm**). Ensure the **Laser** is set to **ON.** Check the laser LED is illuminated at the selected output port on the OmniBER OTN's connector panel.



6 Adjust the optical attenuator to obtain a reading of –34 dBm on the power meter (that is, the receiver minimum sensitivity for 52/155 Mb/s rates). Take note of the attenuator setting.

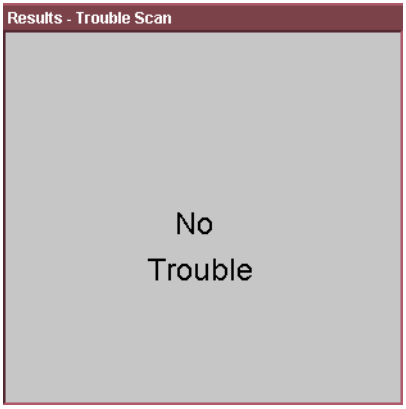
7 Set the optical attenuator to Disable mode.

Note, do not switch OFF the OmniBER OTN laser.

Disconnect the optical attenuator output from the power meter and connect to the OmniBER OTN's **Optical IN** port (52–622 Mb/s). Ensure all optical connectors are clean and all connections are tight with no twists in the optical cable. Set the optical attenuator to Enable.

8 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

9 After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.



10 Add more attenuation by increasing the optical attenuator setting to find the point just before the occurrence of errors. This can be done by observing the Errors LED while adjusting attenuator. Record the additional attenuation setting (typically this will be at least 1 dB). Press **<Run/Stop>** to stop measurement.

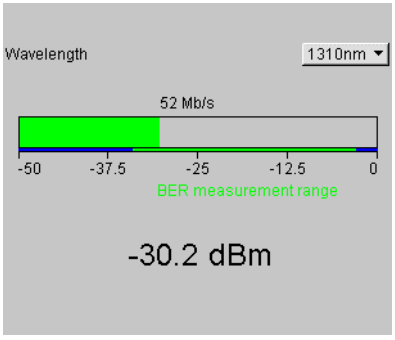
11 Set the optical attenuator to the setting noted in step 6, then reduce setting by a further 4 dB (that is, providing –30 dBm output).

Set the OmniBER OTN's receiver to display **Optical Power** as follows:

Press **<Smart Test>**, choose **Shortcuts > Optical Power** then press **<Select>**. Set **Wavelength** to 1310/1550 nm as appropriate.

Check that the optical power measurement reads between:

-31 dBm and -29 dBm

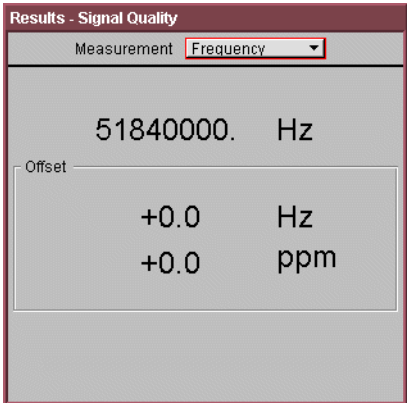


Press **<Smart Test>**, choose **Shortcuts > Frequency Measurement** then press **<Select>**. The OmniBER OTN now displays the received frequency results.

Check that the frequency measurement reads between:

51.83999 and 51.84001 MHz for [STM-0 OPT] or [OC-1]

(155.51999 and 155.52001 MHz for [STM-1 OPT] or [OC-3])



12 Reduce the optical attenuator setting by a further 20 dB and check the receiver **Optical Power** result is between:

–11 dBm and –9 dBm

13 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.

Press **<Run/Stop>** to stop measurement.

14 Disable the optical attenuator then disconnect the optical signal from the OmniBER OTN **Optical IN** port and connect to the power meter. Re-enable the optical attenuator.

15 Check the power meter reading is between:

–10.5 dBm and –9.5 dBm

16 Repeat step 4 through step 15, substituting SIGNAL RATE [OC-3] in step 5.

OC-12/STM-4 Rate

17 Set the OmniBER OTN Transmitter to provide OC-12 output with PRBS bulk payload as follows:

Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Rate** to **OC12**, **Wavelength 1310 nm** (or if this is not fitted, select **1550 nm**). Ensure the **Laser** is set to **ON**.

Check the laser LED is illuminated at the selected output port.

Ensure the optical attenuator and optical power meter are set for the wavelength being used.

18 Adjust the optical attenuator to obtain a reading of –28 dBm on the power meter (that is, the receiver minimum sensitivity for 622 Mb/s rates). Take note of the attenuator setting.

19 Set the optical attenuator to Disable mode.

Note: do not switch OFF the OmniBER OTN laser.

Disconnect the optical attenuator output from the power meter and connect to the OmniBER OTN's **Optical IN** port (51–622 Mb/s). Ensure all optical connectors are clean and all connections are tight with no twists in the optical cable. Set the optical attenuator to Enable.

20 Ensure the OmniBER OTN is set to **TX>RX Coupled Mode**.

21 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.

22 Increase the optical attenuator setting to find the point just before the occurrence of errors by observing the Errors LED while adjusting attenuator. Record the additional attenuation setting. (typically, this will be at least 1 dB). Press **<Run/Stop>** to stop measurement.

23 Re-set the optical attenuator to the setting noted in step 18. (providing –28 dBm output)

Set the OmniBER OTN's receiver to display **Optical Power**. Press **<Smart Test>**, choose **Shortcuts > Optical Power** then press **<Select>**. Set **Wavelength** to 1310/1550 nm as appropriate and check that the optical power measurement reads between:

–29 dBm and –27 dBm

Set the OmniBER OTN's receiver to display **Frequency** and check that the frequency measurement reads between:

622.07999 MHz and 622.08001 MHz

24 Decrease the optical attenuator setting by a further 20 dB and check the receiver **Optical Power** result is between:

–9 dBm and –7 dBm

25 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.

Press **<Run/Stop>** to stop measurement.

26 Disable the optical attenuator then disconnect the optical signal from the OmniBER OTN **Optical IN** port and connect to the power meter. Re-enable the optical attenuator.

27 Check the power meter reading is between:

–8.5 dBm and –7.5 dBm

OC-48/STM-16 Rates

1 Press **<Menu>**, choose **System > Stored Settings** then press **<Select>**. Select **Default** then **Recall**.

2 Set the optical attenuator to:

ATTEN 15 dB

WAVELENGTH 1550 nm (or 1310 nm depending on wavelength used)

CAL=0

ENB ON

Set the optical power meter to

WAVELENGTH 1550 nm (or 1310 nm depending on wavelength used)

Connect the optical attenuator between the power meter and the OmniBER OTN's **Optical Out** port (ensure that all connections are tight and that the cable has no twists).

3 Set the OmniBER OTN Transmitter to provide OC-48 output with PRBS bulk payload as follows:

Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SONET** and **Signal Rate** to **OC48**, **Wavelength 1550 nm** (or if this is not fitted, select **1310 nm**). Ensure the **Laser** is set to **ON**.

Check the laser LED is illuminated at the selected output port.

4 Adjust the optical attenuator to obtain a reading of –28 dBm on the power meter (that is, the receiver minimum sensitivity for 2.5 Gb/s rate). Take note of the attenuator setting.

5 Set the optical attenuator to Disable mode.

Note: do not switch OFF the OmniBER OTN laser.

Disconnect the optical attenuator output from the power meter and connect to the OmniBER OTN's **Optical IN** port (2.5 Gb/s). Ensure all optical connectors are clean and all connections are tight with no twists in the optical cable. Set the optical attenuator to Enable.

6 Set the OmniBER OTN to **TX>RX Coupled Mode**.

7 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.

8 Increase the optical attenuator setting to find the point just before the occurrence of errors by observing the Errors LED while adjusting attenuator. Record the additional attenuation setting. (typically, this will be at least 1 dB). Press **<Run/Stop>** to stop measurement.

9 Re-set optical attenuator to the setting noted in step 4 (providing –28 dBm output)

Set the OmniBER OTN's receiver to display **Optical Power**. Press **<Smart Test>**, choose **Shortcuts > Optical Power** then press **<Select>**. Set **Wavelength** to 1310/1550 nm as appropriate, and check that the optical power measurement reads between:

–30 dBm and –26 dBm

Set the OmniBER OTN's receiver to display **Frequency** and check that the frequency measurement reads between:

2488.3199 MHz and 2488.3201 MHz

10 Reduce the optical attenuator setting by a further 20 dB and check the receiver **Optical Power** result is between:

–10 dBm and –6 dBm

11 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.

Press **<Run/Stop>** to stop measurement.

12 Disable the optical attenuator then disconnect the Optical signal from the OmniBER OTN **Optical IN** port and connect to the power meter. Re-enable the optical attenuator.

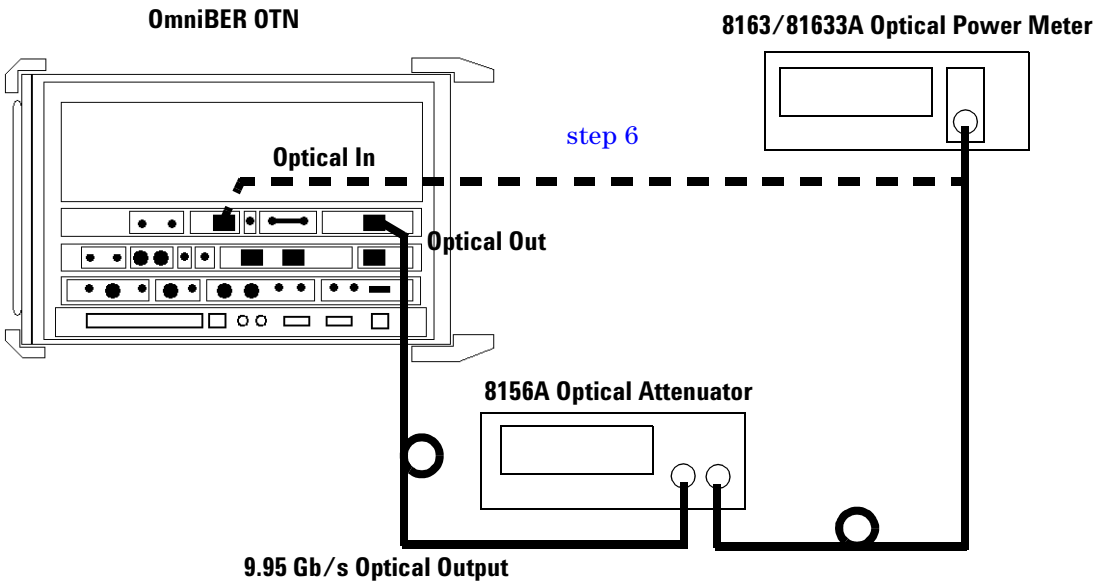
13 Check the power meter reading is between:

–8.5 dBm and –7.5 dBm

OC-192/STM-64 Rate (J7230B and J7232A Opt 108 Only)

1 Press **<Menu>**, choose **System > Stored Settings** then press **<Select>**. Select **Default** then **Recall**.

2 Connect the test setup as shown below.



3 Set the optical attenuator to:

ATTEN 15 dB

WAVELENGTH 1550 nm

CAL=0

ENB ON

Set the optical power meter to

WAVELENGTH 1550 nm

Connect the optical attenuator between the power meter and the OmniBER OTN's **Optical Out** port (ensure that all connections are tight and that the cable has no twists).

4 Set the OmniBER OTN Transmitter to provide OC-192 output with PRBS bulk payload as follows:

Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **SONET** and the **Signal Rate** to **OC192**. Ensure the **Laser** is set to **ON**.

Check the laser LED is illuminated at the 9.95/10.71 Gb/s optical out port.

5 Adjust the optical attenuator to obtain a reading of –18 dBm on the power meter (that is, the receiver minimum sensitivity for 9.95 Gb/s rate). Take note of the attenuator setting.

6 Set the optical attenuator to Disable mode.

Note: do not switch OFF the OmniBER OTN laser.

Disconnect the optical attenuator output from the power meter and connect to the OmniBER OTN's **Optical IN** port (9.95/10.71 Gb/s). Ensure all optical connectors are clean and all connections are tight with no twists in the optical cable. Set the optical attenuator to Enable.

7 Set the OmniBER OTN to **TX>RX Coupled Mode**.

8 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.

9 Increase the optical attenuator setting to find the point just before the occurrence of errors by observing the Errors LED while adjusting attenuator. Record the additional attenuation setting. (typically, this will be at least 1 dB).

Press **<Run/Stop>** to stop measurement.

10 Re-set optical attenuator to the setting noted in step 5 (providing –18dBm output).

Set the OmniBER OTN's receiver to display **Optical Power** and check that the optical power measurement reads between:

–19.5 dBm and –16.5 dBm

Set the OmniBER OTN's receiver to display **Frequency** and check that the frequency measurement reads between:

9953.2799 MHz and 9953.2801 MHz

11 Reduce the optical attenuator setting by 11 dB and check the receiver **Optical Power** result is between:

–8.5 dBm and –5.5 dBm

12 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected. Press **<Run/Stop>** to stop measurement.

13 Disable the optical attenuator then disconnect the Optical signal from the OmniBER OTN **Optical IN** port and connect to the power meter. Re-enable the optical attenuator.

14 Check the power meter reading is between:

–8.5 dBm and –5.5 dBm

10.71 Gb/s Rate (Option 112 Only)

15 Set the OmniBER OTN Transmitter to provide an OTN output with PRBS bulk payload as follows:

Press **<Menu>**, choose **Tx/Rx > Transmitter Settings > Physical** then press **<Select>**. Set the **Signal Mode** to **OTN**. Ensure the **Laser** is set to **ON**.

Check the laser LED is illuminated at the 9.95/10.71 Gb/s optical out port.

16 Adjust the optical attenuator to obtain a reading of –16 dBm on the power meter (that is, the receiver minimum sensitivity for the 10.71 Gb/s rate). Take note of the attenuator setting.

17 Set the optical attenuator to Disable mode.

Note, do not switch OFF the OmniBER OTN laser.

Disconnect the optical attenuator output from the power meter and connect to the OmniBER OTN's **Optical IN** port (9.95/10.71 Gb/s). Ensure all optical connectors are clean and all connections are tight with no twists in the optical cable. Set the optical attenuator to Enable.

18 Ensure the OmniBER OTN to **TX>RX Coupled Mode**.

19 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.

20 Increase the optical attenuator setting to find the point just before the occurrence of errors by observing the Errors LED while adjusting attenuator. Record the additional attenuation setting. (typically, this will be at least 1 dB).

Press **<Run/Stop>** to stop measurement.

21 Re-set optical attenuator to the setting noted in step 16 (providing -16dBm).

Set the OmniBER OTN's receiver to display **Optical Power** and check that the optical power measurement reads between:

–17.5 dBm and –14.5 dBm

Set the OmniBER OTN's receiver to display **Frequency** and check that the frequency measurement reads between:

1070.9224 MHz and 1070.9226 MHz

22 Reduce the optical attenuator setting by 9 dB and check the receiver **Optical Power** result is between:

–8.5 dBm and –5.5 dBm

23 Press **<Smart Test>**, choose **Shortcuts > Trouble Scan** then press **<Select>**. Press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected. Press **<Run/Stop>** to stop measurement.

24 Disable the optical attenuator then disconnect the Optical signal from the OmniBER OTN **Optical IN** port and connect to the power meter. Re-enable the optical attenuator.

25 Check the power meter reading is between:

–8.5 dBm and –5.5 dBm

26 Test Complete. Set Laser to OFF before disconnecting Set-up.

Checking the Receiver Minimum Sensitivity Margin Against Laser Transmitter Extinction Ratio (ER).

The Transmitter Lasers used in the tests have extinction ratio significantly better than the minimum (ER) specification. The table below gives correction factors for a range (ER) values to check the additional receiver sensitivity measured in tests.

Using the extinction ratio results from the **Optical Pulse Mask and Output Characteristics** tests for the laser used confirm the typical 'additional' margin measured in sensitivity tests exceed values in table.

Extinction Ratio measured in Optical Pulse Mask and Output Characteristics Test	Additional Sensitivity
> 8.2 dB to 9 dB	>0.4 dB
> 9 dB to 10 dB	>0.6 dB
> 10 dB to 12 dB	>0.93 dB
> 12 dB to 15 dB	>1.05 dB
> 15 dB to 20 dB	>1.2 dB

Electrical Pulse Mask and Output Level Characteristics (Option 012 Only)

Specifications

Rate	Level	Waveshape
DSX-1	2.4V - 3.6V	Fits Mask T1.102-1993
DS1-LO	As DSX-1 with 655 ft ABAM cable	
DS3-HI	0.9 V pk (nominal)	
DSX-3	560 mV pk (nominal)	Fits Mask T1.102-1993
DS3-900	330mV pl (nominal)	
2 Mb/s Balanced	3.00 V pk (nominal)	As per ITU rec G.703
2 Mb/s Unbalanced	2.37 V pk (nominal)	As per ITU rec G.703
8 Mb/s Unbalanced	2.37 V pk (nominal)	As per ITU rec G.703
34 Mb/s Unbalanced	1.0 V pk (nominal)	As per ITU rec G.703
140 Mb/s Unbalanced	1.0 V ± 0.1 V pk to pk	As per ITU rec G.703
STSX-1 (450 ft)	530 mV pk (nominal)	Compliant with GR-253 Issue 3& ITU-R F.750 Appendix 1
STS-1- HI	1 V pk (nominal)	
STS-1-LO (900 ft)	300 mV pk (nominal)	
STM-0e	1.1 V ± 0.1 V pk	
STS-3/STM-1e	0.5 V ± 0.05 pk	As per ITU rec G.703

Description

This test ensures the Electrical Transmitter output level and pulse shape meet the required specifications. The Transmitter output is connected to an Oscilloscope and the waveshape compared with the predefined masks stored in the Oscilloscope memory. The signal levels are also measured using the Oscilloscope.

Equipment Required

Oscilloscope	54810A with Option 100 Communication Mask Kit (E2625A)
Patch Cable	15512A Siemens 3 pin
Patch Cable	15670A Bantam 110 ohm
Adapter	E2621A Termination Adapter Probe

Procedure

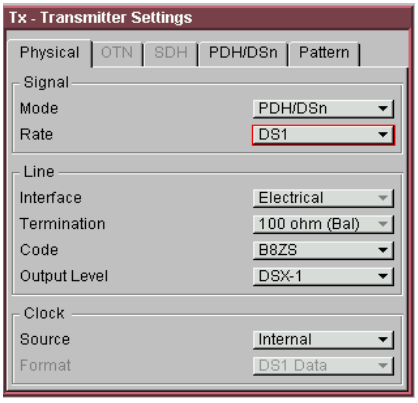
NOTE

This performance test uses the Infinium 54810A Oscilloscope with Option 100 (E2625A) Telecom Masks Template Kit. If any other Oscilloscope is used refer to the scope information for Mask measurement. It is assumed the appropriate Masks are installed in the Infinium.

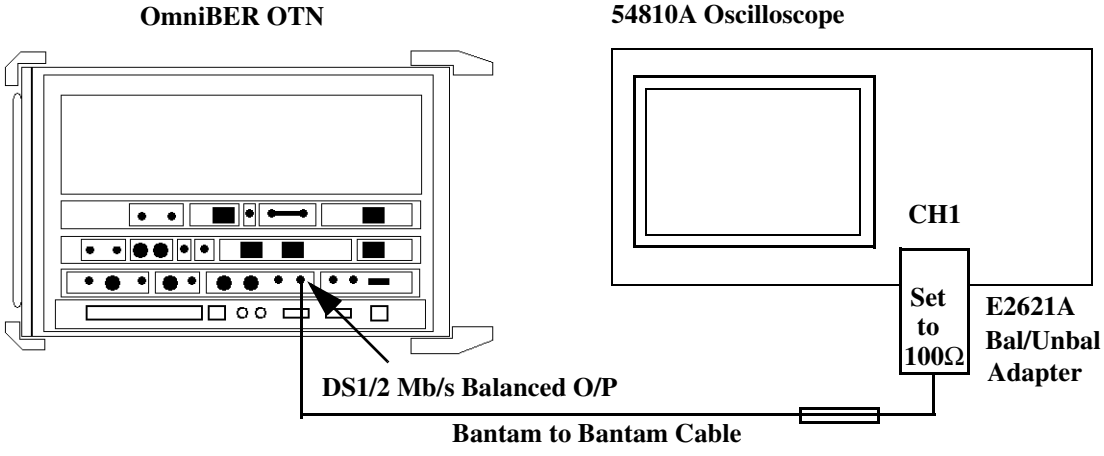
DS1 Output Mask Test

1 Recall the OmniBER OTN's default settings as shown on "Recall Default Settings" on page 11.

2 Press **<Menu>**, select **Tx/Rx > Transmitter Settings** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **DS1** as shown in the example below.

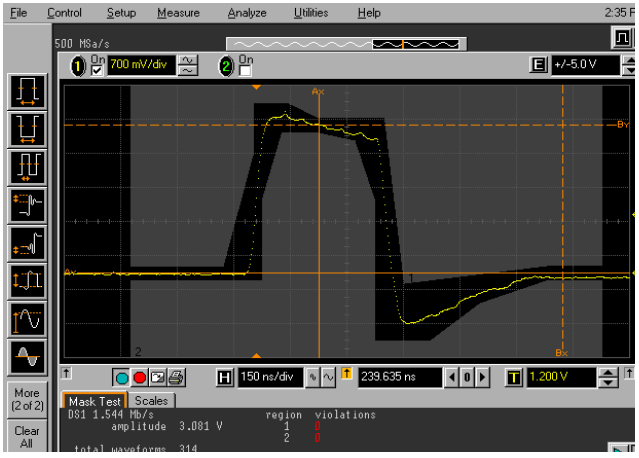


3 Connect the OmniBER OTN's **DS1/2 Mb/s OUT** port to the Oscilloscope using the E2621A Termination Adapter Probe, set probe switch to **100Ω**.



4 Load the **DS1_ANSI.msk** test mask and run the mask test. Check the Positive and Negative pulses are within the mask (see examples).

NOTE To test Negative pulse set the Scope **Mask Test Set-up** panel to **Invert Mask.**



DSX-1 Positive Pulse

DSX-1 Negative Pulse

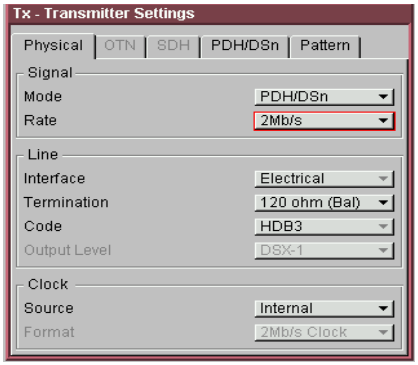
5 Check the DSX-1 pulse amplitudes are between 2.4-3.6V pk.

6 Set the instrument Output Level to DS-1-LO and check that the Pulse Output Amplitude decreases by approximately 20% and pulse shape has slower rise/fall edges.

NOTE The DS1-LO Pulse mask test is not applicable to step 6 and the check is included to provide a functional confirmation of the LO selection.

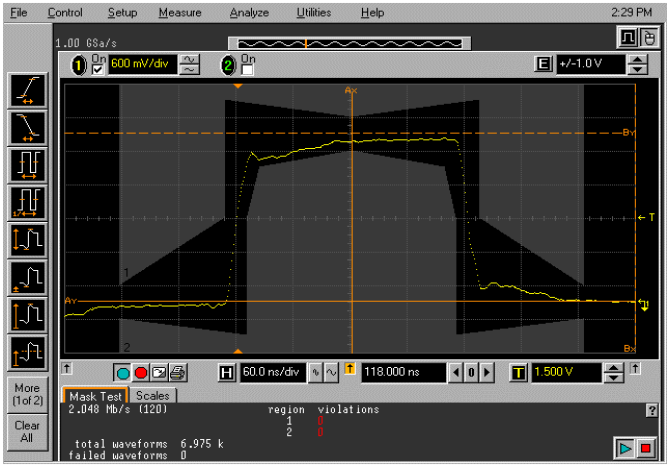
2 Mb/s Balanced Output Mask Tests

1 Press **<Menu>**, select **Tx/Rx > Transmitter** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **2Mb/s,** and **Termination** to **120 ohm (Bal)** and also set E2621A Termination Adapter Probe to 120 ohm.

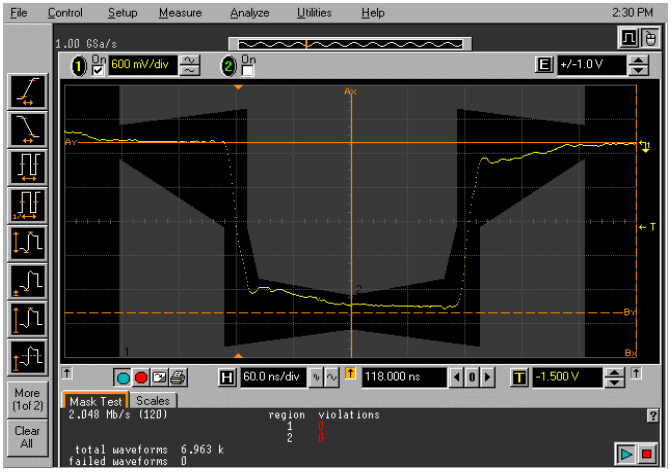


2 Load the **2Mb_ITU_120.msk** test mask and check the Positive and Negative pulses are within the mask (see examples).

NOTE To test Negative pulse set the Scope **Mask Test Set-up** panel to **Invert Mask.**



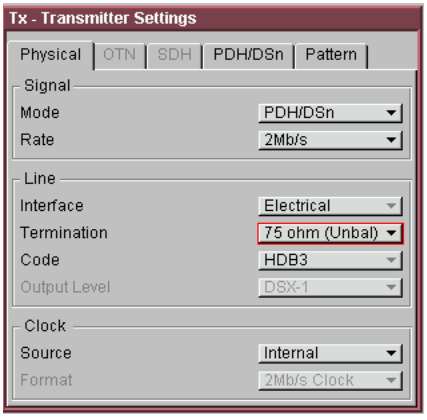
2M Balanced Positive Pulse



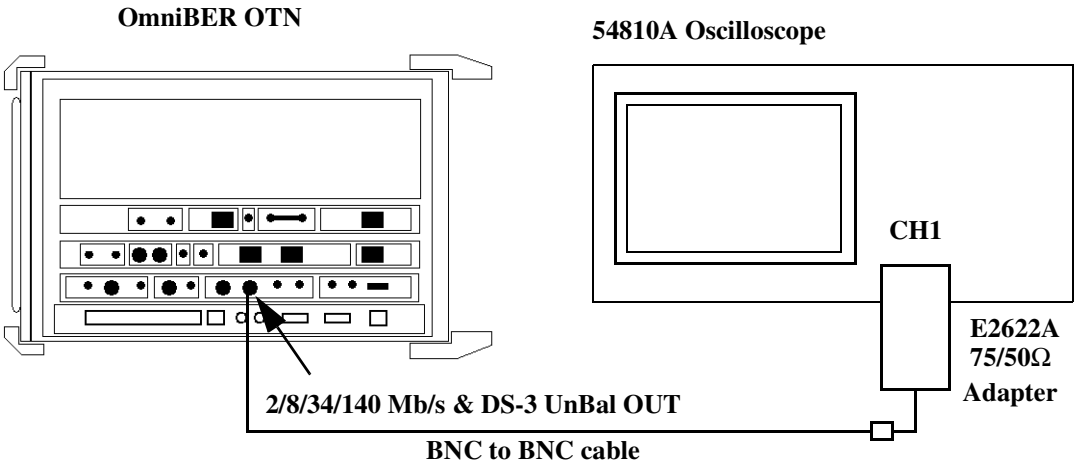
2M Balanced Negative Pulse

2 Mb/s Unbalanced Output Mask Tests

1 Press **<Menu>**, select **Tx/Rx > Transmitter** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **2Mb/s, Termination 75 ohms (Unbal)**.

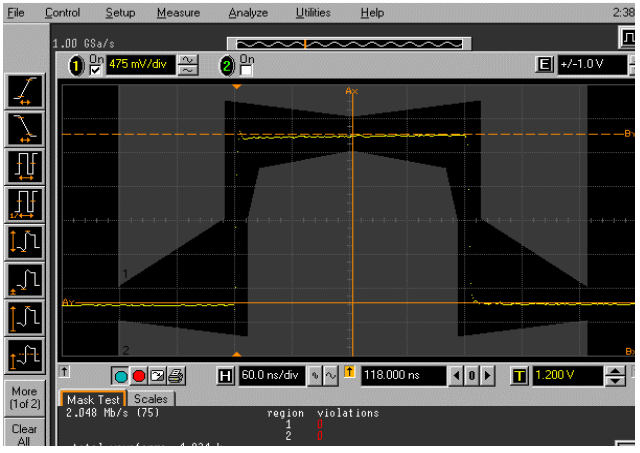


2 Connect the **2 Mb/s BAL OUT** port to the Oscilloscope CHAN 1, using the E2622A Termination Adapter Probe.

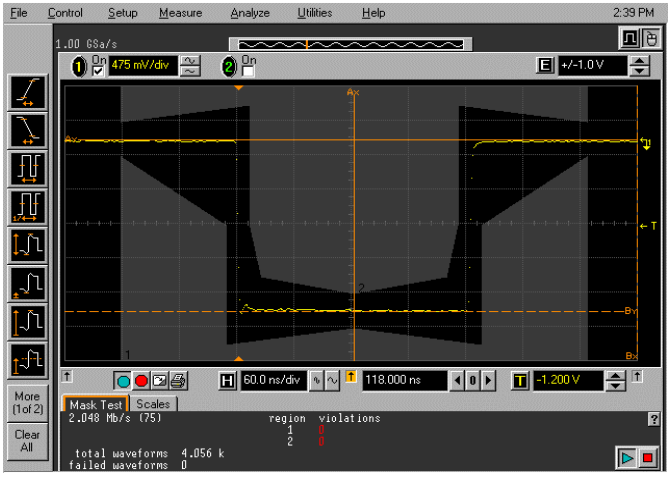


3 Load the **2Mb_ITU_75.msk** test mask and check the Positive and Negative pulses are within the mask (see examples).

NOTE To test Negative pulse set the Scope **Mask Test Set-up** panel to **Invert Mask**



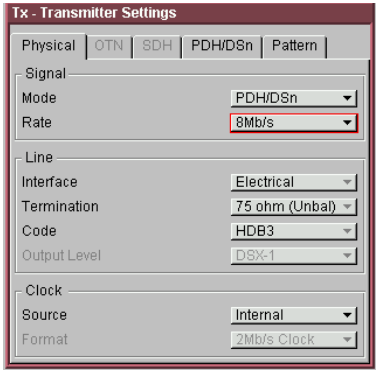
2M Unbalanced Positive Pulse



2M Unbalanced Negative Pulse

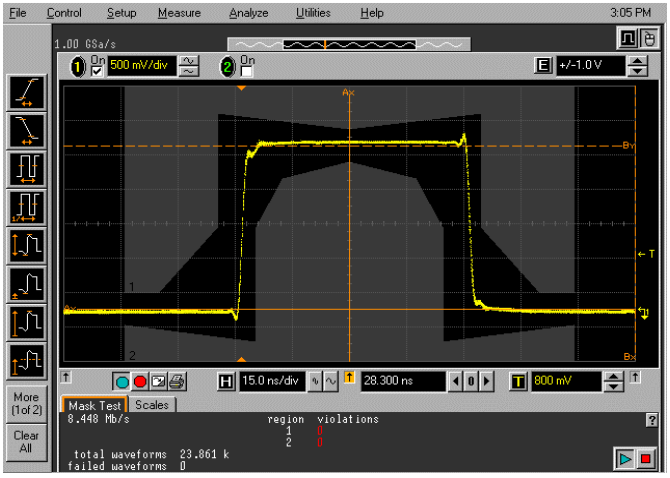
8 Mb/s Output Mask Tests

1 Press **<Menu>**, select **Tx/Rx > Transmitter Settings** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **8 Mb/s**.

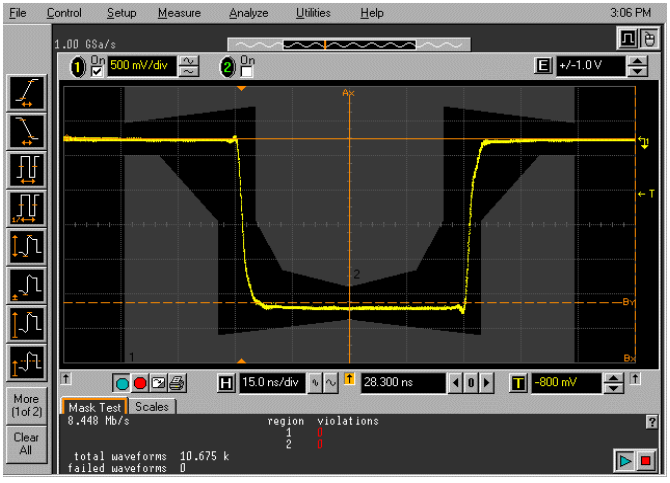


2 Load the **8Mb_ITU.msk** test mask and check the Positive and Negative pulses are within the mask (see examples).

NOTE To test Negative pulse set the Scope **Mask Test Set-up** panel to **Invert Mask**



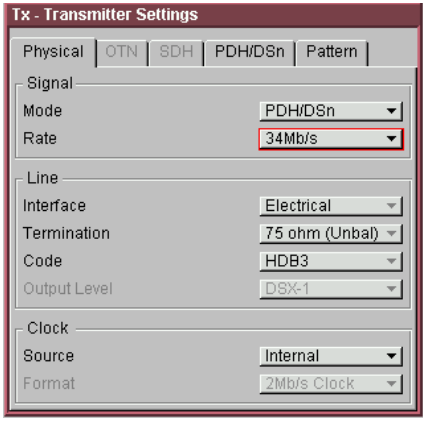
8M Unbalanced Positive Pulse



8M Unbalanced Negative Pulse

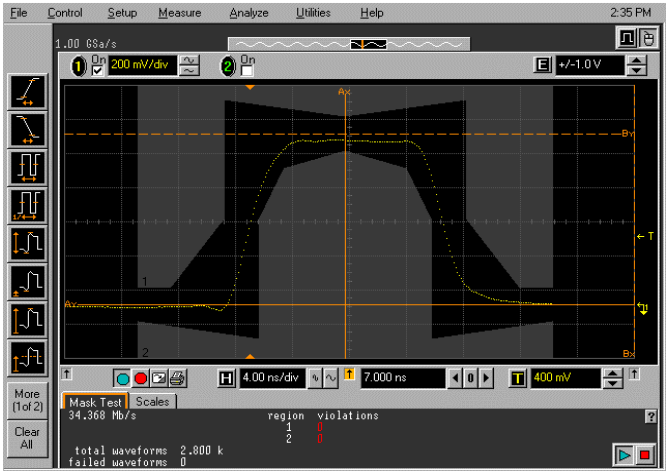
34 Mb/s Output Mask Tests

1 Press **<Menu>,** select **Tx/Rx > Transmitter Settings** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **34 Mb/s**.

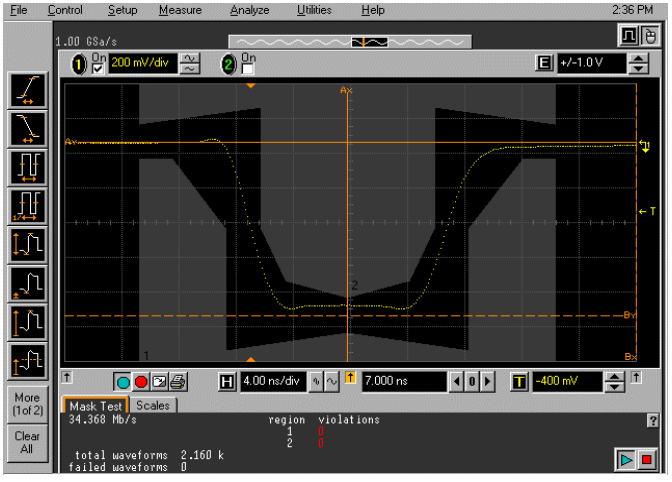


2 Load the **34Mb_ITU.msk** test mask and check the Positive and Negative pulses are within the mask (see examples).

NOTE To test Negative pulse set the Scope **Mask Test Set-up** panel to **Invert Mask**



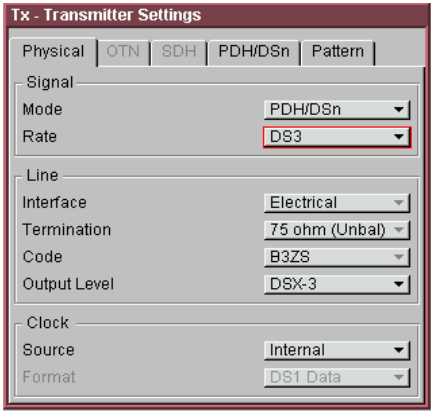
34M Unbalanced Positive Pulse



34M Unbalanced Negative Pulse

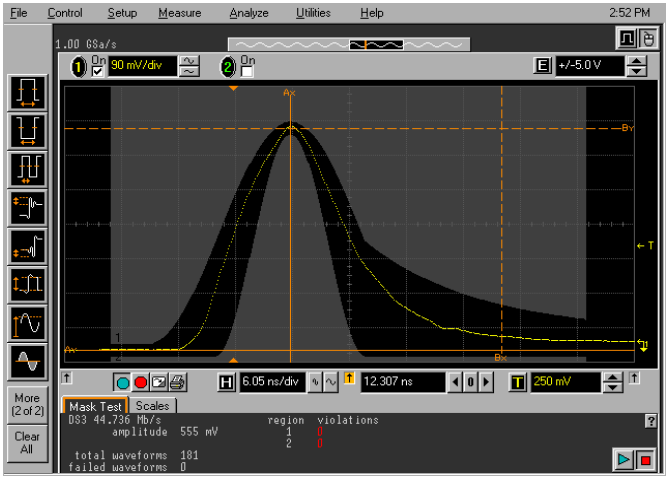
DSX-3 Output Mask Tests

1 Press **<Menu>**, select **Tx/Rx > Transmitter Settings** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **DS3**.

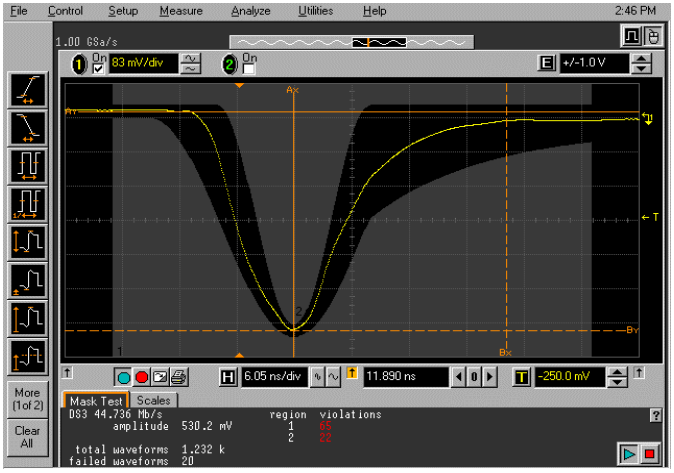


2 Load the **DS3_ANSI.msk** test mask and check the Positive and Negative pulses are within the mask (see examples).

NOTE To test Negative pulse set the Scope **Mask Test Set-up** panel to **Invert Mask**



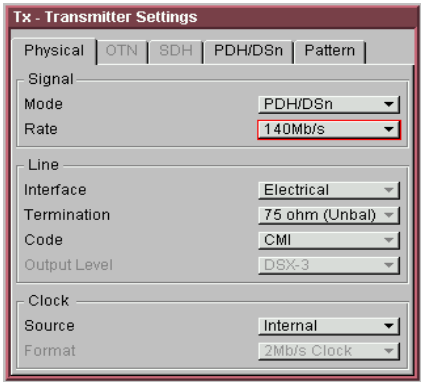
DSX-3 Positive Pulse



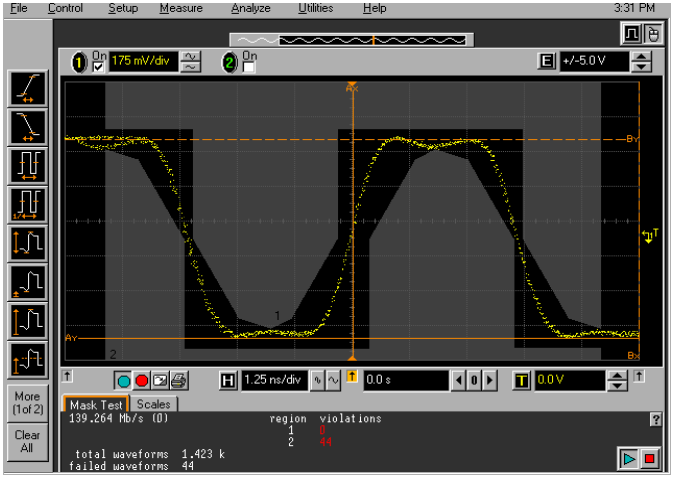
DSX-3 Negative Pulse

140 Mb/s Output Mask Tests

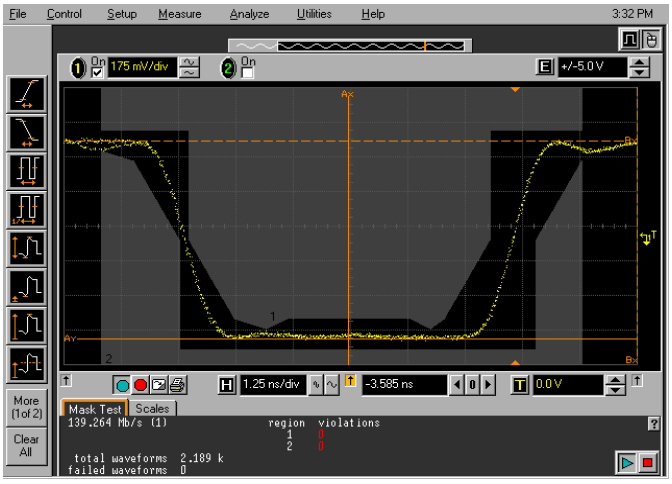
1 Press **<Menu>**, select **Tx/Rx > Transmitter Settings** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **140 Mb/s**.



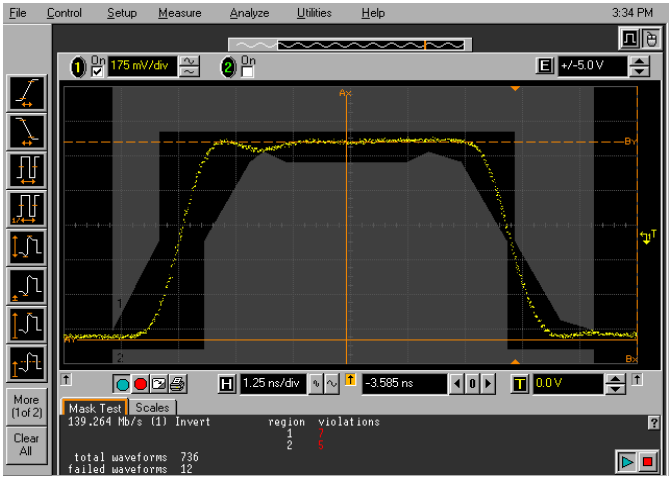
2 Load the **140Mb_ITU_0.msk, 140Mb_ITU_1.msk** and **140Mb_ITU_1_INV.msk** test masks and check each of the pulses are within the mask (see examples).



140Mb/s All Zeros Mask Test



140Mb/s All Ones Mask Test

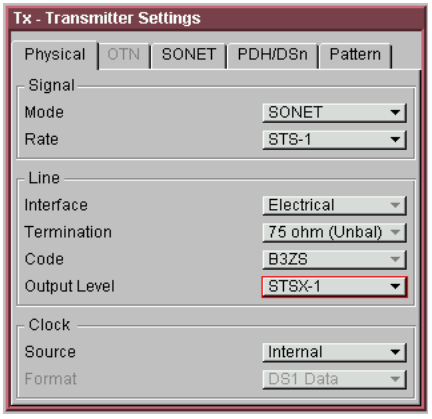


140Mb/s All Ones (inverted) Mask Test

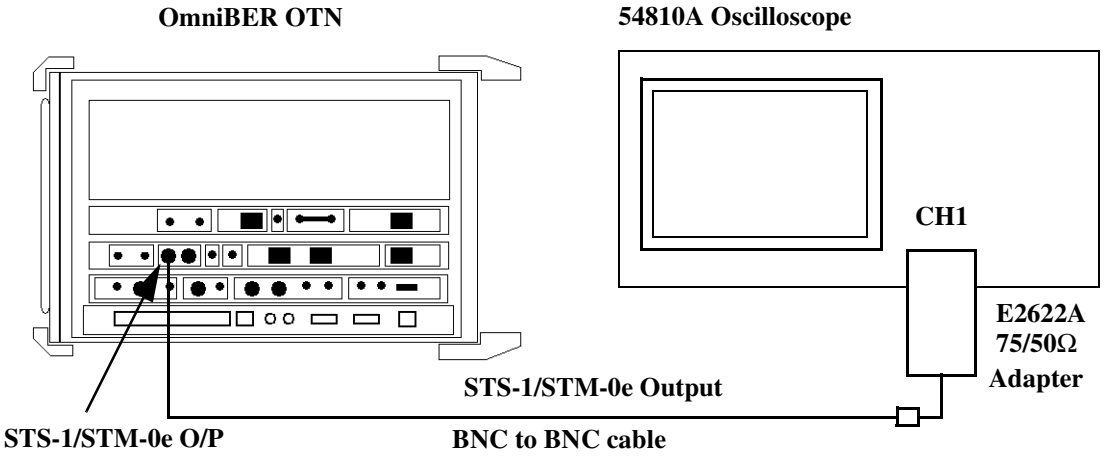
51.84 Mb/s (STS-1) Output Mask Tests

1 Recall the OmniBER OTN's default setting as shown on "Recall Default Settings" on page 11.

2 Press **<Menu>**, select **Tx/Rx > Transmitter Settings** and set the **Signal Mode** to **SONET**. Now set the **Signal Rate** to **STS-1** and set the **Output Level** to **STSX-1.**

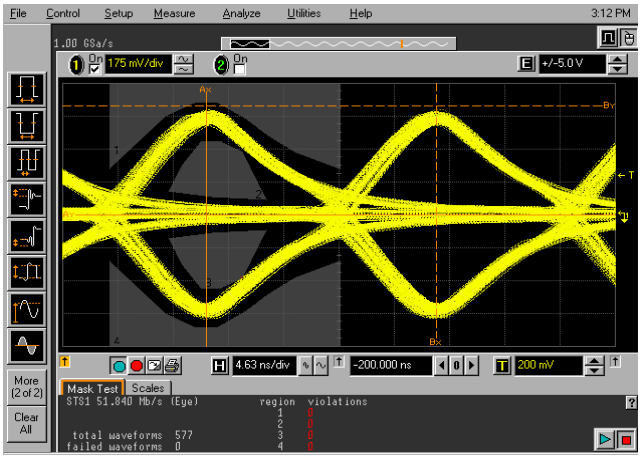


3 Connect the **52 Mb/s OUT** port to the Oscilloscope CHAN 1, using the E2622A Termination Adapter Probe.



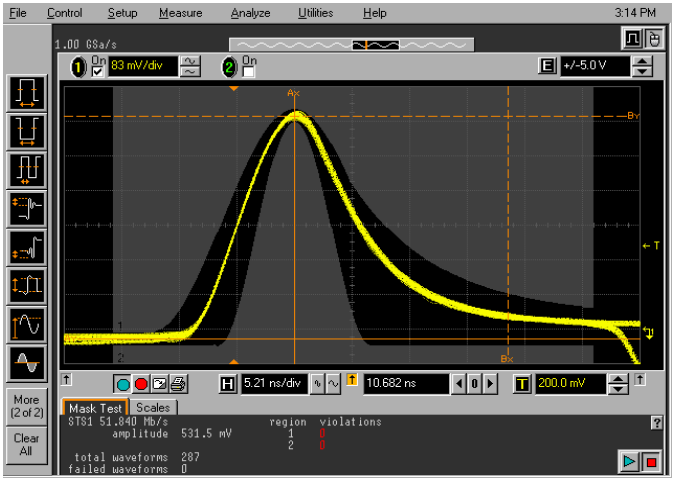
4 Load the **STS1_ANSI_EYE.msk** test mask and check the eye meets the mask. See examples

NOTE It may be necessary to use Manual settings to Align this mask. If necessary change the selection in the scope Mask Test Set-up to allow manual settings rather than File Set-up for Alignment.



STSX-1 Mask Test

5 Load the **STS1_ANSI_PULSE.msk** test mask and check the positive and negative pulses meet the mask (see examples).

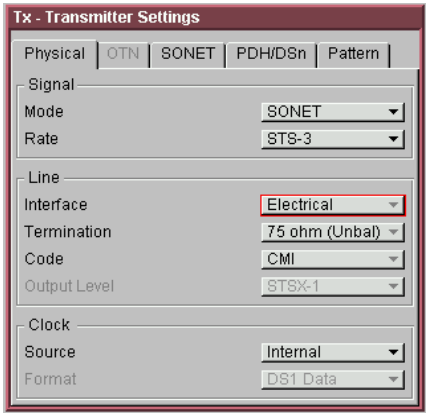


STSX-1 Positive Pulse Mask Test

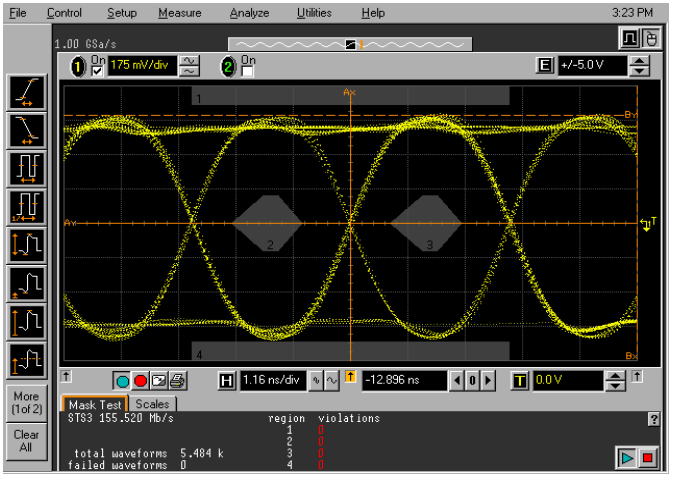
STSX-1 Negative Pulse Mask Test

155Mb/s Output Mask Tests

1 Press **<Menu>,** select **Tx/Rx > Transmitter Settings** and set the **Signal Mode** to **SONET**. Now set the **Signal Rate** to **STS-3**.



2 Load the **STS3_ANSI.msk** test mask and check the eye meets the mask (see example).

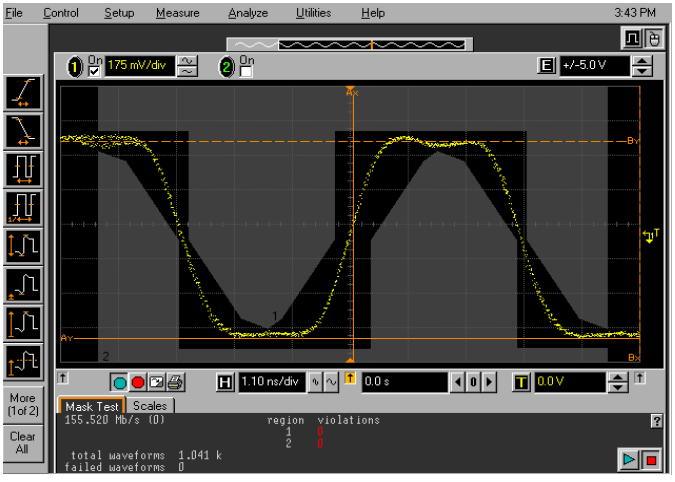


STS-3 Eye Mask Test

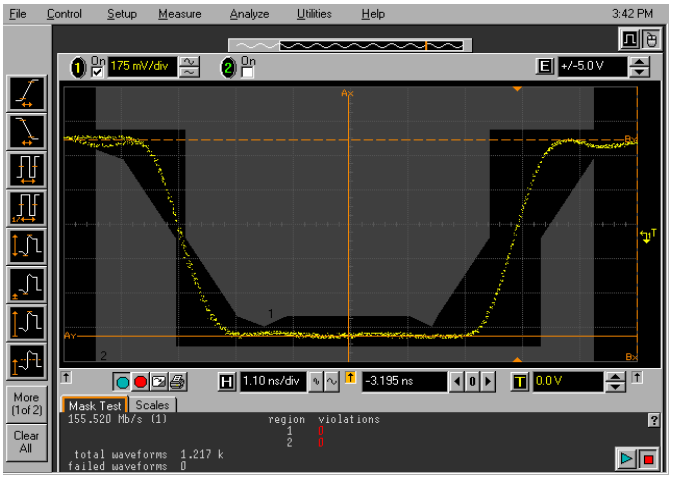
3 Press **<Menu>**, select **Tx/Rx > Transmitter settings** and set the **Signal Mode** to **SDH**. Now set the **Signal Rate** to **STM-1,** and **Interface** to **Electrical**.

4 Load the **155Mb_ITU_0.msk** test mask and check the 'zero' pulses are within the mask. See examples.

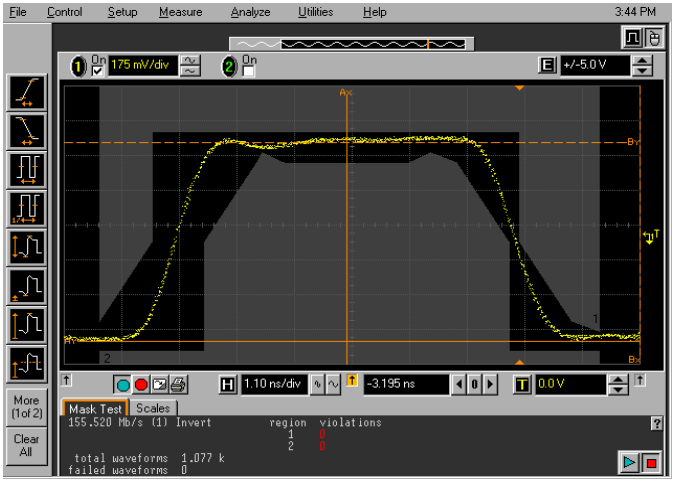
5 Also check the 'ones' pulses (normal & inverted) by loading and checking against the **155Mb_ITU_1.msk** and **155_ITU_1_INV.msk** test masks (see examples).



STM-1 All Zeros Mask Test



STM-1 All Ones Mask Test



STM-1 All Ones (inverted) Mask Test

Performance Test Record

Model: Agilent J7231B/J7232A OmniBER OTN	
Location:	**Serial No.:**
Tested by:	**Options:**
Temperature:	**Certified by:**
Humidity:	**Date:**

NOTE The test steps applicable are dependent on the instrument options installed. Enter N/A if a test section does not apply for your instrument.

Page No.	Test Description		Min	Result Actual	Max
Performance Self Test					
15	step 5	Confidence Test		Pass/Fail	
15	step 6	Frequency Measurement		Pass/Fail	
Internal Reference Clock Accuracy					
20	step 4	2 MHz Clock OUT	2.0479908 MHz		2.0480092 MHz
22	step 13	DS1 Clock OUT	–4.5 ppm		+4.5 ppm
23	step 2	Alternative DS1 Test (Counter indication for framed signal)	1.540993 MHz		1.541007 MHz
External Clock Reference Inputs and Clock Reference Output					
26	step 6	2 MHz Clock Ext	2.047999999 MHz		2.048000001 MHz
27	step 7	Signal Locked		Pass/Fail	
27	step 10/step 6	10 MHz Clock Ext	2.047999999 MHz		2.048000001 MHz

Page No.	Test Description		Min	Result Actual	Max
27	step 10/step 7	Signal Locked		Pass/Fail	
28	step 16	2 Mb/s Data Ext Unbal	2.047999999 MHz		2.048000001 MHz
29	step 17	Signal Locked		Pass/Fail	
29	step 21	2 Mb/s Data Ext Bal	2.047999999 MHz		2.048000001 MHz
29	step 22	Signal Locked		Pass/Fail	
30	step 26	No Alarm/Errors		Pass/Fail	
30	step 27	DS1 Ext	1543999 Hz		1544001 Hz
30	step 28	Signal Locked		Pass/Fail	
Optical Pulse Mask and Output Characteristics					
Option 104/106	**1310nm Optical Port (52 Mb/s - 2.5 Gb/s)**				
35	step 9	OC-1/STM-0 Mask		Pass/Fail	
35	step 11	OC-1/STM-0 (ER)	>8.2 dB		N/A
36	step 16	OC-3/STM-1 Mask		Pass/Fail	
36	step 18	OC-3/STM-1 (ER)	>8.2 dB		N/A
36	step 23	OC-12/STM-4 Mask		Pass/Fail	
36	step 25	OC-12/STM-4 (ER)	>8.2 dB		N/A
38	step 33	OC-48/STM-16 Mask		Pass/Fail	
39	step 35	OC-48/STM-16 (PWR)	–2.5 dBm		+4 dBm
39	step 36	OC-48/STM-16 (ER)	>8.2 dB	Pass/Fail	N/A
Option 105/106	**1550nm Optical Port (52 Mb/s - 2.5 Gb/s)**				
35	step 9	OC-1/STM-0 Mask		Pass/Fail	
35	step 11	OC-1/STM-0 (ER)	>8.2 dB		N/A
36	step 16	OC-3/STM-1 Mask		Pass/Fail	
36	step 18	OC-3/STM-1 (ER)	>8.2 dB		N/A

Page No.	Test Description		Min	Result Actual	Max
36	step 23	OC-12/STM-4 Mask		Pass/Fail	
36	step 25	OC-12/STM-4 (ER)	>8.2 dB		N/A
38	step 33	OC-48/STM-16 Mask		Pass/Fail	
39	step 35	OC-48/STM-16 (PWR)	–2.5 dBm		+4 dBm
39	step 36	OC-48/STM-16 (ER)	>8.2 dB	Pass/Fail	N/A
	1550nm Optical Port (9.95 Gb/s and 10.7 Gb/s)				
J7230B and J7232A Opt 108 only					
41	step 8	OC-192/STM-64 Mask		Pass/Fail	
41	step 10	OC-192/STM-64 (PWR)	–1 dBm		+2 dBm
42	step 11	OC-192/STM-64 (ER)	>8.2 dB	Pass/Fail	
Option 112					
43	step 17	OTU-2 Output Mask		Pass/Fail	
43	step 19	OTU-2 Output (PWR)	–1 dBm		+2 dBm
43	step 19	OTU-2 Output (ER)	>8.2 dB	Pass/Fail	
Optical Receiver Sensitivity, Optical Power and Frequency Measurement					
	Optical Receive Port (52 & 155 Mb/s)				
All options					
49	step 5	Laser LED ON		Pass/Fail	
49	step 6	Note Attenuator Setting	N/A		N/A
49	step 9	'No Trouble' Min Sens		Pass/Fail	
50	step 10	Additional Attenuation	Typ > 1 dB		N/A
50	step 11	–30 dBm PWR meas	–31 dBm		–29 dBm
50	step 11	OC-1/STM-0 Frequency	51.83999 MHz		51.84001 MHz
51	step 12	–10 dBm PWR meas	–11 dBm		–9 dBm

Page No.	Test Description		Min	Result Actual	Max
52	step 13	'No Trouble' Max Sens		Pass/Fail	
52	step 15	Power Meter check	–10.5		–9.5
49	step 5	Laser LED ON		Pass/Fail	
49	step 6	Note Attenuator Setting	N/A		N/A
49	step 9	'No Trouble' Min Sens		Pass/Fail	
50	step 10	Additional Attenuation	Typ > 1 dB		N/A
50	step 11	–30 dBm PWR meas	–31 dBm		–29 dBm
50	step 11	OC-3 /STM-1 Frequency	155.51999 MHz		155.52001 MHz
51	step 12	–10 dBm PWR meas	–11 dBm		–9 dBm
52	step 13	'No Trouble' Max Sens		Pass/Fail	
52	step 15	Power Meter check	–10.5		–9.5
	Optical Receive Port (622 Mb/s)				
52	step 17	Laser LED ON		Pass/Fail	
52	step 18	Note Attenuator Setting	N/A		N/A
53	step 21	'No Trouble' Min Sens		Pass/Fail	
53	step 22	Additional Attenuation	Typ > 1 dB		N/A
53	step 23	–28 dBm PWR meas	–29 dBm		–27 dBm
53	step 23	OC-12/STM-4 Frequency	622.07999 MHz		622.08001 MHz
53	step 24	–8 dBm PWR meas	–9 dBm		–7 dBm
53	step 25	'No Trouble' Max Sens		Pass/Fail	
53	step 27	Power Meter check	–8.5		–7.5
	Optical Receive Port (2.5 Gb/s)				
54	step 3	Laser LED ON		Pass/Fail	

Page No.	Test Description		Min	Result Actual	Max
54	step 4	Note Attenuator Setting	N/A		N/A
55	step 7	'No Trouble' Min Sens		Pass/Fail	
55	step 8	Additional Attenuation	Typ > 1 dB		N/A
55	step 9	–28 dBm PWR meas	–30 dBm		–26 dBm
55	step 9	OC-48/STM-16 Frequency	2488.3199 MHz		2488.3201 MHz
55	step 10	–8 dBm PWR meas	–10 dBm		–6 dBm
55	step 11	'No Trouble' Max Sens		Pass/Fail	
56	step 14	Power Meter check	–8.5		–7.5
	Optical Receive Port (9.95 and 10.7 Gb/s)				
J7230B and J7232A Opt 108 only					
58	step 4	Laser LED ON		Pass/Fail	
58	step 5	Note Attenuator Setting	N/A		N/A
58	step 8	'No Trouble' Min Sens		Pass/Fail	
58	step 9	Additional Attenuation	Typ > 1 dB		N/A
58	step 10	–18dBm PWR meas	–19.5 dBm		–16.5 dBm
58	step 10	OC-192/STM-64 Frequency	9953.2799 MHz		9953.2801 MHz
59	step 11	–7 dBm PWR meas	–8.5 dBm		–5.5 dBm
59	step 12	'No Trouble' Max Sens		Pass/Fail	
59	step 14	Power Meter check	–8.5 dBm		–5.5 dBm
Option 112					
59	step 15	Laser LED ON		Pass/Fail	
59	step 16	Note Attenuator Setting	N/A		N/A

Page No.	Test Description		Min	Result Actual	Max
60	step 19	'No Trouble' Min Sens		Pass/Fail	
60	step 20	Additional Attenuation	Typ > 1 dB		N/A
60	step 21	–16dBm PWR meas	–17.5 dBm		–14.5 dBm
60	step 21	OTN Output Frequency	1070.9224 MHz		1070.9226 MHz
60	step 22	–7 dBm PWR meas	–8.5 dBm		–5.5 dBm
60	step 23	'No Trouble' Max Sens		Pass/Fail	
61	step 25	Power Meter check	–8.5 dBm		–5.5 dBm
All options					
61	**Check Receiver Sensitivity margin v.s. Transmitter Extinction Ratio**			Pass/Fail	
Electrical Pulse Mask and Output Characteristics (opt 012 Only)					
	DS1 Output Mask Tests				
66	step 4	DS1 ANSI Mask		Pass/Fail	
67	step 5	DSX-1 Pulse Amplitudes		Pass/Fail	
67	step 6	DSX1-LO Output Level		Pass/Fail	
	2 Mb/s Balanced Output Mask Tests				
68	step 2	2 Mb/s ITU 120 Mask		Pass/Fail	
70	step 3	2 Mb/s ITU 75 Mask		Pass/Fail	
	8 Mb/s Output Mask Tests				
72	step	8 Mb/s ITU Mask		Pass/Fail	
	34 Mb/s Output Mask Tests				
74	step 2	34 Mb/s ITU Mask		Pass/Fail	
	DS3 Output Mask Tests				

Page No.	Test Description		Min	Result Actual	Max
76	step 2	DS3 ANSI Mask		Pass/Fail	
	140 Mb/s Output Mask Tests				
78	step 2	140 Mb/s ITU Masks		Pass/Fail	
	STS-1 (51 Mb/s) Output Mask Tests				
81	step 4	STS-1 Eye Mask		Pass/Fail	
83	step 5	STS-1 ANSI Mask		Pass/Fail	
	STS-3 Output Mask Tests				
84	step 2	STS-3 ANSI Mask		Pass/Fail	
85	step 4	155 Mb/s ITU_0 Mask		Pass/Fail	
85	step 5	155 Mb/s ITU_1s Mask		Pass/Fail	

2
Self Test Overview

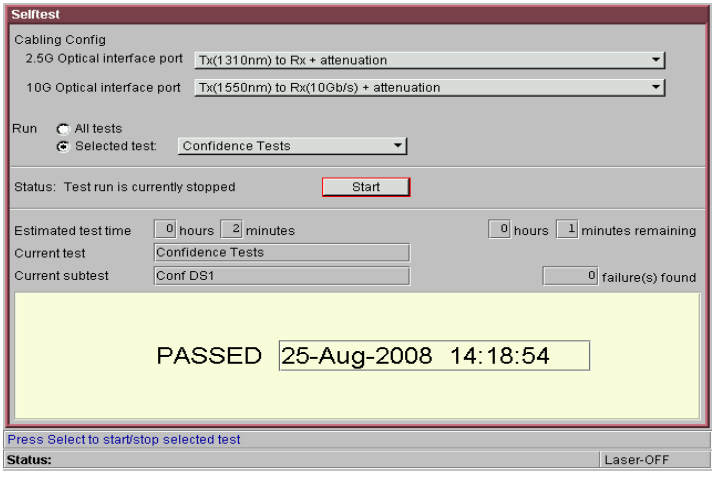
The instrument self test consists of a number of tests and sub-tests designed to verify the functionality of the instrument measurement and utility ports as well verify the major hardware paths within the instrument.

This section gives an overview of the instrument self tests available on the instrument.

Description of the Self Test

The self test comprises several tests each consisting of a number of sub tests (the tests available and number of sub tests within each test is option dependent). Self test can be run as one complete sequence or an individual test may be run. If a failure occurs, then a descriptive text message and fail code is returned. An error example is provided at the end of this section.

The self test is selected by pressing the **<Menu>** key then selecting **System > Self Test**. An example of the self test page in selected test mode is shown below.



List of Self Tests

The self test comprises of several tests. Each test consists of a number of sub tests. A brief description of each test is given below. The tests available are dependent on the model and option of the instrument.

The self test can be run in one of two modes **Run > All Tests** or **Run > Selected Test**.

Title	Description
Confidence Test	This test checks the optical and the electrical paths. A basic signal continuity check is performed. This involves verifying the signal configuration by injecting/detecting a single error.
Optical Power Test	This test checks both the data paths and the optical power measurement circuitry.
DCC Add/Drop Test	The test checks the data paths associated with the DCC add/drop hardware. The DCC loopback should be fitted for this test.
Frequency Test	This test checks the data path through the clock offset and frequency measurement hardware. The test checks the absolute clock offset frequency result.
OTN FEC Test	This test checks both the data paths and the OTN FEC algorithm are operating correctly.
VCAT RAM Test	This test checks the memory used for VCAT delay generation and also that basic Ethernet Over SONET (EOS) is operational

Loopback Connections Required for Self Test

The self test loopbacks required for each test are listed below. Those required are dependent on the model, options fitted and test selected. See diagram on page 99 indicating loopback connections for a J7230B with options 106 & 012.

Optical Loopback Connections (Dependent on instrument wavelength options fitted)

Use optical cables P/N 1005-0337 and 15 dB attenuator P/N 1005-0433. Units with 9.95/10.71 Gb/s option also use 10 dB attenuator P/N 1005-1148.

- Connect 9.95/10.71 Gb/s Optical Out <> 10 dB Attenuator <> 9.95/10.71 Gb/s Optical In
- Connect 52 Mb/s-2.5 Gb/s Optical Out <> 15 dB Attenuator <> 52 Mb/s-2.5 Gb/s Optical In

Electrical Connections SONET/SDH 52 Mb/s to 155 Mb/s Use BNC cable P/N 15525A

- Connect SONET/SDH Out (BNC) <> SONET/SDH In (BNC)

Unbalanced Electrical Connections PDH/DSn 2-140 Mb/s and DS3 (Instruments with Option 012 only)

Use BNC cable P/N 15525A

- Connect 2-140 Mb/s DS3 Out (BNC) <> 2-140 Mb/s DS3 In (BNC)

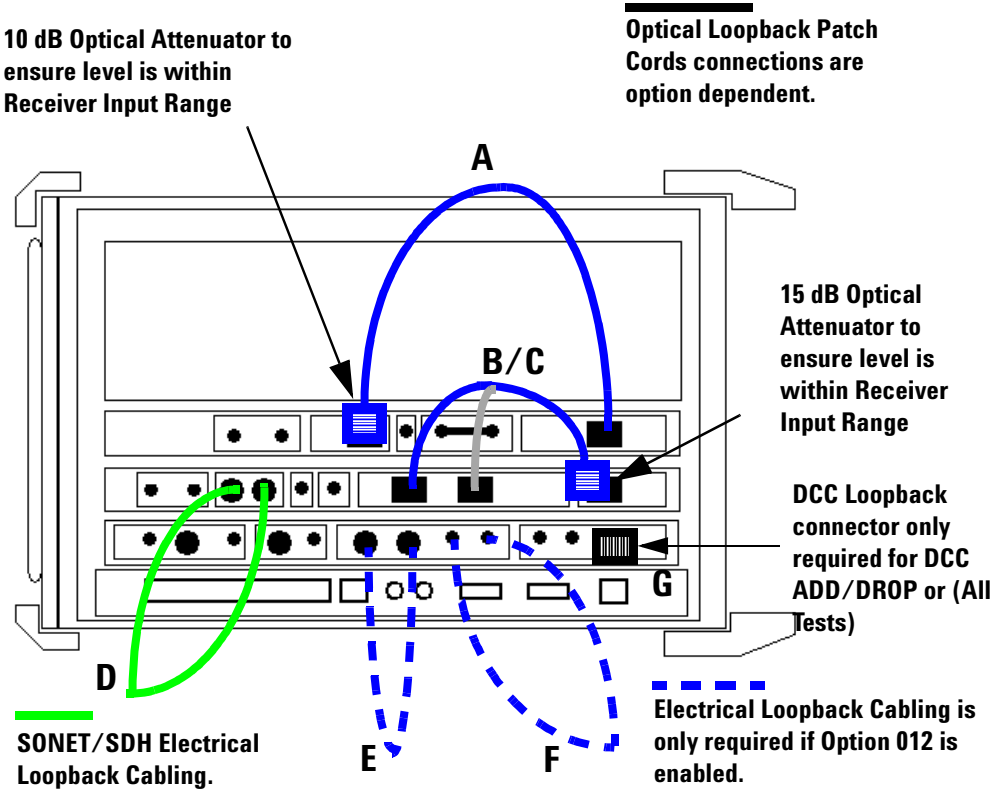
Balanced Electrical Connections 2M/DS1 (Instruments with Option 012 only)

Use Bantam cable P/N 15670A

- Connect 2M Out <> 2M In
- Connect DS1 Out <> DS1 In

DCC Loopback Connector

- Connect DCC loopback plug to 9-pin DCC port P/N J2125-65011



Loopback connections shown for option J7230B with options 106/012

CAUTION Safety precautions care and connection cleanliness must be observed to ensure that the optical connections are not damaged or degraded. Ensure the recommended optical attenuation is present in all optical loopback connections as failure to do so could cause self test failure or damage to the optical receivers.

This table indicates the minimum self test loopback requirements.

Self Test	Optical Loopback (10/15 dB in-line attenuation must be used)	Electrical Loopback	DCC Loopback plug
	Loopbacks used are dependent on Options fitted		
• **All tests**	**A, B/C**	**D,E,F**	**G**
• Confidence Test	A, B/C	D,E,F	not required
Confidence Tests (10Gb/s Optics)	A		
Confidence Tests (2.5Gb/s - 52 Mb/s Optics)	B and C		
Confidence Tests Unbalanced SDH/SONET Electrical Ports (155 &- 52 Mb/s)		D	
Confidence Tests(E1, E2, E3, E4 & DS-3 Unbalanced Ports)		E	
Confidence Tests (DS1/ E1 Balanced Ports)		F	
• Optical Power Test	A, B or C	not required	not required
• DCC Add/Drop Test	A, B, or C	not required	G
• Frequency Test	A, B and C	D,E,F	not required
• OTN FEC Test	A		
• VCAT RAM Test	B or C		
•			

NOTE

For units with dual wavelength, 1310 & 1550 ports at 52 Mb/s - 2.5 Gb/s. The self test should be repeated with the optional optical loopback B/C connection (including attenuator) made to alternative wavelength port. self test port selection should match the wavelength being tested.

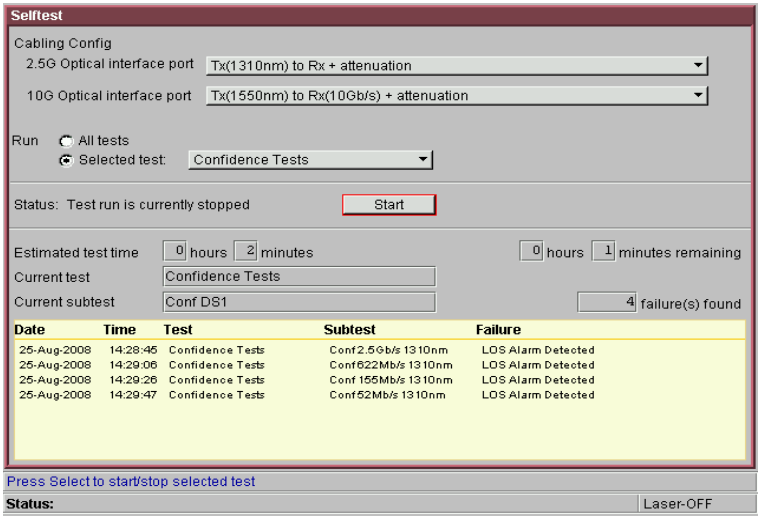
How to Run a Self Test

1. Press **<Menu>**, choose **System > Self Test** then press **<Select>**.
2. Ensure all loopbacks are in place and from the self test page menu select the appropriate 1310/1550 nm 2.5 G - 52 M optical loopback cabling configuration. Loopback accordingly, taking care to ensure attenuation is provided in the optical loopback paths.
3. On the self test page choose **Run Selected Test** and choose the selected test. Choose **START** to begin the test.
4. The self test will now run, selecting each sub test in sequence. The remaining test time to complete the tests is displayed on the right hand side of the self test page.
5. If any sub test fails an error message and error code will be returned. Up to five sub test errors can be logged before the test ends/aborts.
6. End of procedure.

Error messages and codes

The approximate test time for selected test is shown on the self test display. Most tests only take 1-2 minutes to complete. If no errors are recorded then all sub tests have passed, indicated by ‘PASSED’ - time in the lower display. If any sub test fails, an error message is returned along with an error code which returns test number, sub test number. An example of a test failure is shown in the following figure.

If a test fails check all the appropriate loopback required for the test/tests selected are in place. Repeat test and refer to “What to do if Self Test fails if necessary.



List of Self Test Sub Tests

A list of all the possible sub tests in any given Test is shown below. Each interface is tested in sequence starting with the highest rate interface down to the lowest rate interface. The actual number of sub tests run is dependent on the instrument options fitted, for example single or dual wavelength.

- Confidence Test

Sub Test Number	Sub Test Description
1	Conf 10 Gb/s 1550 nm - Opt Power
2	Conf 10 Gb/s 1550 nm - AU-4-64c
3	Conf 10 Gb/s 1550 nm - AU-4-16c
4	Conf 2.5 Gb/s 1310 nm - Opt Power
5	Conf 2.5 Gb/s 1310 nm
6	Conf 2.5 Gb/s 1550 nm
7	Conf 622 Mb/s 1310 nm
8	Conf 622 Mb/s 1550 nm
9	Conf 155 Mb/s 1310 nm
10	Conf 155 Mb/s 1550 nm
11	Conf 52 Mb/s 1310 nm
12	Conf 52 Mb/s 1550 nm
13 (opt 012 only)	Conf 155 Mb/s
14 (opt 012 only)	Conf 52 Mb/s
15 (opt 012 only)	Conf E4 Unbal
16 (opt 012 only)	Conf E3 Unbal
17 (opt 012 only)	Conf E2 Unbal
18 (opt 012 only)	Conf E1 Unbal
19 (opt 012 only)	Conf E1 Bal
20 (opt 012 only)	Conf DS3 Unbal
21 (opt 012 only)	Conf DS1Bal
22 (opt 112 only)	10.7 Gb/s - Opt Power

23 (opt 112 only)	10.7 Gb/s Test Signal
24 (opt 112 only)	10.7 Gb/s SDH Payload

Optical Power Test

Sub Test Number	Sub Test Description
1	10 Gb/s 1550nm
2	2.5 Gb/s 1310/1550nm
3	622 Mb/s 1310/1550nm

- DCC Add/Drop Test

Sub Test Number	Sub Test Description
1	Performed at the maximum available DCC/GCC channel rate

- Frequency Measurement

Sub Test Number	Sub Test Description
1	Performed at the maximum available Optical line rate
2	E4 Unbal
3	E1 Bal

OTN FEC Test

Sub Test Number	Sub Test Description
1	OTU2 Test Signal PRBS

- VCAT RAM Test

Sub Test Number	Sub Test Description
1	STM-16, AU-3-48v, VC-3 Bulk, PRBS
2	STM-16, AU-3-48v, VC-3 GFP (F), Ethernet PRBS

-What to Do if the Self Test Fails

1. Check all connections to make sure that all the correct loopback connections are in place and Optical Attenuators are fitted as required.
2. Be suspicious of any optical interface failures and if necessary clean all optical connections with a recognized cleaning kit before retrying the self test.
3. Carefully check the Error Code/Messages, in particular ensure all of the required loopback connections are made.
4. If the problem persists then contact your local Agilent Service Office or representative.

Tips and Checks to Confirm Correct Optical Loopback

- Make sure connectors are located in key/notch of the port connectors to ensure full insertion.
- Check Transmitter and Receiver are set to the same Signal Rate and that the correct Laser is On when test is being Run.
- Press **<Smart Test>**, choose **Shortcuts > Optical Power** then press **<Select>**. Check the Received signal level is in the Green BER measurement power range.
- Ensure all optical connections are clean and fully connected with no sharp bends or twists in the optical patch cord. Check the Optical Cord and Attenuator are not damaged and/or substitute with equivalent.
- If problem relates to a particular operation Rate, Mode or Function perform a manual Back to Back operation check to confirm signal path.

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In This Book

This book contains verification information for the OmniBER OTN instrument.

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