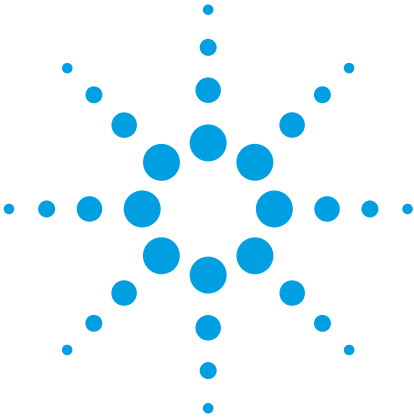


Agilent J7230A

OmniBER OTN
10 Gb/s communications
performance analyzer

Installation and
Verification Manual





Agilent J7230A

OmniBER OTN

**Installation and
Verification Manual**



Agilent Technologies

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Manual Part Number

J7230-90035

Edition

First edition, January 2003

Printed in UK

Agilent Technologies UK Limited
Telecommunications Networks Test
Division
South Queensferry, West Lothian, Scotland
EH30 9TG

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Safety Notices

CAUTION

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

WARNING

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

In This Manual...

You will find information for installing and verifying the performance of your instrument

1 Introduction

This chapter provides a brief description of the product and also all safety requirements the user should be aware of when using the instrument.

2 Installation (Getting Started)

This chapter provides general information on how to install and connect up the instrument.

3 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.

4 Self Test Overview

This chapter details all of the Self Test procedures.

5 ETSI/ANSI Terminology

This chapter provides a table explaining the equivalent SDH/SONET terms.

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.

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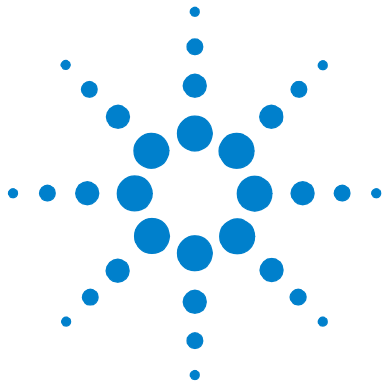
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This chapter provides a brief description of the product and also all safety requirements you should be aware of when using the instrument.



Product Description

The Agilent OmniBER OTN provides all the test capability you need to test the performance of today's high-capacity transmission systems and networks, in one portable package.



- ITU-T G.709 test at 10.71 Gb/s and 2.66 Gb/s
- SONET/SDH plus PDH/DSn test at all rates from 1.5Mb/s to 10Gb/s
- Generation of mixed mappings
- Simultaneous all-channel testing (up to 192 STSs/AUs)
- Comprehensive OTN/SONET/SDH overhead testing
- Alarm stress testing
- Transmit and Receive event output triggers
- Thru-mode operation - transparent and overwrite
- Comprehensive online help
- Graphical measurement results
- See "[Option Guide](#)" on page 11, for more product details.

Option Guide

This guide explains the features offered with the instrument mainframe and its associated options.

For more information, see:

- [“Mainframe Test Rate Capability”](#) on page 11
- [“OTN Interfaces”](#) on page 12
- [“PDH/DSn Testing”](#) on page 12
- [“Optical Interfaces”](#) on page 12
- [“Mixed Mappings”](#) on page 13
- [“Optical Connectors \(product options\)”](#) on page 13
- [“Alternative Optical Connectors \(available accessories\)”](#) on page 13
- [“Other Options”](#) on page 13
- [“Accessories”](#) on page 14

Mainframe Test Rate Capability

Optical Test Interfaces	Mainframe
OC-1, OC-3, OC-12, OC-48, OC-192 STM-0, STM-1, STM-4, STM-16, STM-64	J7230A

Configuration	Mainframe
Side mounted connectors	J7230A - 004
Rear mounted connectors	J7230A - 005

OTN Interfaces

Optical Test Interfaces	G.709 Options
Adds OTU-1 at 2.66Gb/s	J7230A - 111
Adds OTU-2 at 10.71Gb/s	J7230A - 112

PDH/DSn Testing

Adds	DSn/PDH option
DSn/PDH framed/unframed testing plus DSn/PDH electrical interfaces	J7230A - 012

Optical Interfaces

	Wavelength	Option
52 Mb/s to 2.5 Gb/s not required		J7230A - 100
All rates up to 2.5 Gb/s (must be ordered with option J7230A - 111)		J7230A - 101
Select one wavelength option for optical interfaces up to 2.66 Gb/s	1310 nm optical transmitter	J7230A - 104
	1550 nm optical transmitter	J7230A - 105
	1310/1550 nm optical transmitter	J7230A - 106
Optical Interfaces operating at 10 and 10.7 Gb/s	1550 nm optical transmitter	J7230A - 108

NOTE

52 Mb/s to 2.66 Gb/s optical options include 52 Mb/s and 155 Mb/s electrical interfaces.

Mixed Mappings

Adds	Mixed mappings option
Firmware only option that adds mixed mappings plus STS-6c, -9c, -24c and VC-4-2c, -4-3c, -4-8c	J7230A - 510

Optical Connectors (product options)

Connector	Option
FC/PC Adapters fitted on all optical interfaces	J7230A - 609
SC Adapters fitted on all optical interfaces	J7230A - 610
ST Adapters fitted on all optical interfaces	J7230A - 611

Alternative Optical Connectors (available accessories)

Alternative optical connectors are available for your product; order the appropriate J7283A (FC/PC), J7284A (SC) or J7285A (ST) accessory (connector). The number of connectors required for your product is shown below.

	J7283A (FC/PC)	J7284A (SC)	J7285A (ST)
J7230A - 104/105	4	4	4
J7230A - 106	5	5	5
J7230A - 100	2	2	2

Other Options

Certificate of Calibration

Option UK6: Calibration certificate with test data

Warranty and Service Plans

Terms and conditions of the applicable warranty for this product are contained in the sales and related documentation supplied separately.

Please contact your nearest Agilent Technologies Sales Office for further information on warranty and extended warranty options.

For access to Agilent Product information and sales/service contacts, please visit <http://www.agilent.com>.

Accessories

Carrying Cases

J7266A: Hard transit case (for J7230A option 004)

Optical Adapters and Cables

J7283A: FC/PC optical connector (exchangeable)

J7284A: SC optical connector (exchangeable)

J7285A: ST optical connector (exchangeable)

J7281A: DCC port converter cable: 9-pin miniature D-type to 37-pin D-type (RS-449, female)

J7269A: Trigger Output Connector, DCC port to two BNC connectors.

General Information

Responsibilities of the Customer

The customer shall provide:

- 1 Access to the products during the specified periods of coverage to perform maintenance.
- 2 Adequate working space around the products for servicing by Agilent personnel.
- 3 Access to and use of all information and facilities determined necessary by Agilent to service and/or maintain the products. (Insofar as these items may contain proprietary or classified information, the customer shall assume full responsibility for safeguarding and protection from wrongful use.
- 4 Routine operator maintenance and cleaning as specified in the Agilent Operating and Service Manuals.
- 5 Consumables such as paper, disks, magnetic tapes, ribbons, inks, pens, gases, solvents, columns, syringes, lamps, septa, needles, filters, frits, fuses, seals, detector flow cell windows, etc.

Certification

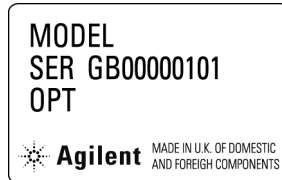
Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility and to the calibration facilities of other International Standards Organization members.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent products.

Instruments Covered By Manual

Attached to the **rear panel** of the instrument is a serial number plate. The serial number plate has a two letter reference denoting country of origin (GB = Great Britain) and an eight digit serial number. The serial number is unique to each instrument and should be quoted in all correspondence with Agilent, especially when ordering replacement parts.



Serial Number Plate

Storage and Shipment

The instrument may be stored or shipped in environments within the following limits:

Temperature

-40 to +75 degC

Altitude

Up to 4,600 meters (15,000 feet)

The instrument should also be protected from temperature extremes which could cause condensation within the instrument.

Repackaging for Shipment

Shipping to Service Centers. You can re-use the packaging, if in its original condition, for onwards transportation and to return the instrument for calibration or servicing. If the instrument is being returned to Agilent for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. In any correspondence, refer to the instrument by model number and full serial number.

Shipping/Transit to Customer Sites A hard transit case is available as an optional accessory. (Order item no. J7266A: Hard transit case for J7230A). It is recommended that these are used for shipping to your customer sites. The hard case should always be used when transporting the instrument in an aircraft hold.

CAUTION

The instrument cover should always be fitted when transporting the instrument.

Other Packaging. The following general instructions should be followed when repackaging with commercially available materials:

- Wrap instrument in heavy paper or plastic. If the instrument is being shipped to Agilent, attach a tag indicating the type of service required, return address, model number and full serial number.
- Use a strong shipping container. A double wall carton made of 350 pound test material is adequate.
- Use a layer of shock absorbing material 70 to 100 mm (3 to 4 inch) thick, around all sides of the instrument to provide firm cushioning and prevent movement inside the container. Protect the Front Panel controls and Top Panel connectors with cardboard.
- Seal shipping container securely.
- Mark shipping container FRAGILE to ensure careful handling.
- In any correspondence, refer to instrument by model number and full serial number.

Weight and Dimensions

Weight	15.2 kg (33.5 lb)
Dimensions	300 x 365 x 450 mm (11.75 x 14.5 x 17.75 in) (height x width x depth)

Safety Information

For safety information, read the following sections:

- [“Safety Precautions”](#) on page 19
- [“Safety Symbols”](#) on page 20
- [“Connecting to the Network”](#) on page 21
- [“Additional Precautions for Service Engineers”](#) on page 24
- [“Avoiding Problems When Making Measurements”](#) on page 26

Safety Precautions

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer’s failure to comply with these requirements.

In particular, the operator should note the following safety information:

- [“Safety Symbols”](#) on page 20
- [“Operators Maintenance”](#) on page 27

WARNING

DO NOT operate damaged equipment. Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to an Agilent Sales and Service Office for service and repair to ensure the safety features are maintained.

Refer to [“Laser Warning Symbols”](#) on page 23 for information on the laser warning labels on the instrument.

Safety Symbols

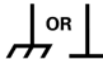
The following symbols on the instrument and in the manual indicate precautions which must be taken to maintain safe operation of the instrument.



The Instruction Documentation Symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the supplied documentation.



Indicates the field wiring terminal that must be connected to earth ground before operating the equipment - protects against electrical shock in case of fault.



Frame or chassis ground terminal - typically connects to the equipment's metal frame.



Alternating current (AC).



Direct current (DC).



Indicates hazardous voltages.

WARNING

Warning denotes a hazard. It calls attention to a procedure, which if not correctly performed or adhered to could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.

CAUTION

Caution denotes a hazard. It calls attention to a procedure, which if not correctly performed or adhered to could result in damage to or destruction of the instrument. Do not proceed beyond a caution note until the indicated conditions are fully understood and met.



Indicates that a laser is fitted. The user must refer to the manual for specific Warning or Caution information to avoid personal injury or damage to the product.

Connecting to the Network

Connectors for connecting to the network are located on the top of the instrument. The connections available depend on the options fitted to your instrument.

For more information, see:

- [“Laser Warnings and Cautions”](#) on page 21
- [“Avoiding Optical Receiver Overload”](#) on page 23
- [“Cleaning Optical Connectors”](#) on page 27
- [“Additional Precautions for Service Engineers”](#) on page 24

Laser Warnings and Cautions

Before connecting, note the Warning and Caution information given.

All Connectors

CAUTION



When connecting or disconnecting, ensure that you are grounded or, make contact with the metal surface of the Mainframe with your free hand to bring you, the module, and the mainframe to the same static potential.

Modules remain susceptible to ESD damage while the module is installed in the Mainframe Additional ESD information is required when servicing, see your Verification manual for further information.

Optical Interface Connectors

For your protection, review all laser information given in this manual before installing or using the instrument.

WARNING

To prevent personal injury, avoid use that may be hazardous to others, and maintain the test set in a safe condition. Ensure the information given below is reviewed before operating the test set.

Laser Product Classification

All optical modules are classified as Class I (non-hazardous) laser product in the USA which complies with the United States Food and Drug Administration (FDA) Standard 21 CFR Ch.1 1040.10, and are classified as Class 1 (non-hazardous) laser products in Europe which complies with EN 60825-1 (1994).

To avoid hazardous exposure to laser radiation, it is recommended that the following practices are observed during system operation:

- ALWAYS DEACTIVATE THE LASER BEFORE CONNECTING OR DISCONNECTING OPTICAL CABLES.
- When connecting or disconnecting optical cables between the test set and device-under-test, observe the connection sequences given below.

Connecting: Connect the optical cable to the input of the device-under-test before connecting to any of the instrument's **Optical Out** connectors. When connecting to the **Optical In** ports ensure the power level never exceeds the maximum stated limit for that port. Also ensure that the power level of a signal applied to an instrument receive port is within the recommended operating level for that port. Recommended input operating power levels for each input port are printed on the connector panel adjacent to the port.

Disconnecting: Disconnect the optical cable from the **Optical Out** connector before disconnecting from the device-under-test. Always close the fiber optic connector dust caps over the laser aperture.

- NEVER examine or stare into the open end of a broken, severed, or disconnected optical cable when it is connected to one of the Transmission Test Set Optical Out connectors.
- Arrange for service-trained personnel, who are aware of the hazards involved, to repair optical cables.

Laser Warning Symbols

The instrument's connector panel has the following label:

CLASS 1 LASER PRODUCT

CLASS 1 LASER PRODUCT translates as follows:

Finnish - LUOKAN 1 LASERLAITE

Finnish/Swedish - KLASS 1 LASER APPARAT

This label indicates that the radiant energy present in this instrument is non-hazardous.

Avoiding Optical Receiver Overload

Check when connecting an optical transmitter to an optical receiver that you do not overload the receiver. This applies to elements under test and also the receiver input ports.

Check for Status messages on the instrument display warning of overload conditions.

On the connector panel the following output/input power level information is printed:

Tx Optical Out ports: Maximum available output power.

Rx Optical In ports: Maximum input power (damage level) the receiver input can accept before damage occurs. Recommended input power operating range for signals applied to the receiver.

When performing tests, it is recommended that you drive the optical receiver with a signal that has an average power in the middle of the receiver's operating range (mid-way between the upper and lower levels printed next to the Optical In port).

Additional Precautions for Service Engineers

Safety Precautions

DO NOT substitute parts or modify equipment. Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Sales and Service Office for service and repair to ensure the safety features are maintained.

DO NOT service or adjust alone. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, service personnel must not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

Review "[Safety Precautions](#)" on page 19.

ESD Precautions

CAUTION



When making connections to the instrument, review "[Connecting to the Network](#)" on page 21.

The instrument contains components sensitive to electrostatic discharge. To prevent component damage, carefully follow the handling precautions presented below.

The smallest static voltage most people can feel is about 3500 volts. It takes less than one tenth of that (about 300 volts) to destroy or severely damage static sensitive circuits. Often, static damage does not immediately cause a malfunction but significantly reduces the component's life.

Adhering to the following precautions will reduce the risk of static discharge damage.

Keep the assembly in its conductive storage box/bag when not installed in the Mainframe. Save the box/bag for future storage of the assembly.

Before handling the assembly, select a work area where potential static sources are minimized. Avoid working in carpeted areas and non-conductive chairs. Keep body movement to a minimum. Agilent recommends that you use a controlled static workstation.

Avoid touching any components or edge connectors. When you install the assembly, keep one hand in contact with the protective bag as you pick up the assembly with your other hand. Then, before installing the assembly, ensure that you are grounded or make contact with the metal surface of the Mainframe with your free hand to bring you, the assembly, and the mainframe to the same static potential. This also applies whenever you connect or disconnect cables on the instrument.

Avoiding Problems When Making Measurements

Bit errors can occur due to network defects (such as faulty network elements, damaged optical fiber or dust/dirt particles in the fiber connections) or problems with the test environment/setup. Follow the steps below to avoid problems when making measurements.

▶ **To avoid introducing errors when performing tests:**

- 1** Ensure that optical fibers connecting the instrument to the network are not damaged - check that fibers have not been crimped.
- 2** Avoid acute bends in the fiber. Ensure that fibers only have gentle arcs.
- 3** If the instrument is left unattended for a long term test, ensure that the equipment is not in a position where people will disturb the connecting fibers.
- 4** Ensure that all fiber connections are clean and dirt-free. Use a fiberscope to measure the cleanliness of a (unpowered) fiber. A poorly cleaned fiber results in a drop in power. Alternatively, use a power meter (e.g. the instrument's internal power meter) to measure the power at the end of a fiber, the other end of which is connected to the network.
- 5** Before connection is made, always clean the connector ferrule tip with acetone or alcohol using a cotton swab. Dry the connector with compressed air. Failure to maintain cleanliness of connectors is liable to cause excessive insertion loss.
- 6** Ensure that the correct time and date is set on the instrument.

Operators Maintenance

WARNING

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

Maintenance appropriate for the operator is:

- Cabinet cleaning - clean the cabinet using a dry cloth only.
- [Cleaning Optical Connectors](#)
- Cleaning SMA Connectors.
- Ensure ventilating fan cover is clean.

Cleaning Optical Connectors

You should clean the optical connectors at regular intervals using the following materials:

Description	Agilent Part Number
Compressed Air Can or Blow Brush	
Isopropyl Alcohol	8500-5344
Lens Cleaning Paper	9300-0761
Swabs	5080-5400

CAUTION

Do not insert any tool or object into the optical IN or OUT ports of the instrument as damage to or contamination of the optical fiber may result.



To clean the optical connectors

- 1 Disconnect the instrument from the Power Line or switch off the laser transmitter before commencing this cleaning procedure.

- 2 Remove the adapters from the optical IN and OUT ports by flipping back the lever on the optical adapter.
- 3 Using the blow brush with the brush removed blow through the ferrule of the standard flexible connector and the adapter.
- 4 If the optical fiber of the fixed connector requires further cleaning this entails disassembly of the module. This should be carried out only by suitably trained service personnel.
- 5 Apply some isopropyl alcohol to a piece of the cleaning paper and clean the barrel of the adapter. Using a new piece of cleaning paper, clean the face of the adapter. Repeat this operation, using a new piece of cleaning paper each time.
- 6 Use a blow brush or compressed air to remove any particles of cleaning paper which may be present.
- 7 These procedures also apply to any Optical patch cords or attenuators used to avoid subsequent contamination/damage to the Optical ports.

Replace the adapters in the optical connector. Secure in place by clicking the retaining lever back into position.

Cleaning SMA Connectors

Depending on application and environment it may be appropriate to clean the grounding threads of SMA connectors (and SMA semi-rigid links where fitted) using the following materials: This ensures optimum connection and signal screening.

Description	Agilent Part Number
Compressed Air Can or Blow Brush	
Isopropyl Alcohol	8500-5344
Lens Cleaning Paper	9300-0761
Swabs	5080-5400

CAUTION

Do not insert any tool or object into the SMA connector ports to avoid damage.

▶ To clean the SMA connectors

- 1** Disconnect the instrument from the Power Line before commencing this cleaning procedure.
- 2** Apply some isopropyl alcohol to a piece of the clean lint-free cloth and clean the outer threads of SMA bulkhead connectors taking care not to introduce cleaning fluid into center connection.
- 3** Where a unit has SMA semi-rigid links carefully remove ONE of these using an appropriate spanner, taking note of position and orientation. Clean the bulkhead connectors as in step 2 and clean the inside threads of the SMA link taking care not to bend/damage the center connector pin.
- 4** Carefully refit the link taking care not to mis-thread or overtighten, as damage could result in an expensive repair. Always use a torque spanner to refit and set to 0.9 Nm.
- 5** Repeat for other SMA links and also any SMA cables used in the test configuration to avoid subsequent contamination of instrument connectors.

Statement of Compliance

This instrument has been designed and tested in accordance with IEC Publication 61010-1 (1990) + A1:1992 + A2(1995) Safety requirements for Electrical Equipment for Measurement, Control and Laboratory Use, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.



The CE mark shows that the product complies with all relevant European legal Directives.

ISM 1-A

This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.

ICES/NMB-001

This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.



The CSA mark is a registered trademark of the Canadian Standards Association.



Australian EMC Regulations

The C-Tick mark is a registered trademark of the Australian Communications Authority. This signifies compliance with the Australian EMC Framework Regulations under the terms of the Radiocommunications Act of 1992.

Noise Declaration (German)

LpA<70dB

am Arbeitsplatz (operator position)

normaler Betrieb (normal position)

nach DIN 45635 pt.19 (per ISO 7779)

Electromagnetic Compatibility

This product conforms with the protection requirements of European Council Directive 89/336/EEC for Electromagnetic Compatibility (EMC).

The conformity assessment requirements have been met using the technical Construction file route to compliance, using EMC test specifications EN 55011:1991 (Group 1, Class A) and EN 50082-1:1992.

In order to preserve the EMC performance of the product, any cable which becomes worn or damaged must be replaced with the same type and specification.

See also “10 Base-T Lan Connection Radiated Emissions” on page 43.

Declaration of Conformity

A Declaration of Conformity is provided on the CD-ROM shipped with your instrument.

1 Introduction



2 Installation (Getting Started)

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This chapter provides general information on how to install and connect up the instrument, and how to check that the instrument operates correctly on delivery.



Preparation

Initial Inspection

WARNING

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure.

Inspect the shipping container for damage.

If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked both mechanically and electrically.

For procedures for checking operation on delivery See [“Operation Checks on Delivery”](#) on page 41.

If the contents of the shipment are incomplete, if there is mechanical damage or defect, notify the nearest Agilent Office.

If the instrument does not pass the delivery checks given (See [“Operation Checks on Delivery”](#) on page 41.) notify the nearest Agilent office.

If the shipping container is also damaged, or the cushioning material shows signs of stress, notify the carrier as well as the nearest Agilent office. Keep the shipping materials for the carrier’s inspection. The Agilent office will arrange for repair or replacement without waiting for claim settlement.

Operating Environment

DO NOT operate the product in an explosive atmosphere or in the presence of flammable gasses or fumes.

This instrument may be operated in environments within the following limits:

Temperature: 0 to +40 degC (option 004); 0 to +45 degC (option 005).

Altitude: Up to 3050 m (10,000 ft).

Humidity: Up to 90% relative humidity to 40°C, but it should be protected from temperature extremes which may cause condensation.

To ensure adequate cooling, do not obstruct air vents in the instrument cabinet.

CAUTION

This instrument is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010-1 and IEC 60664 respectively.

Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

This product is suitable for indoor use only.

Preparation for Use

WARNING

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

Power Requirements

The instrument requires a power source of 100 to 240 V ac at a frequency between 47 and 63 Hz (nominal).

Power consumption: 250VA.

There are no customer replaceable fuses in the instrument.

Connecting to the Power Supply

WARNING

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

The mains switch fitted to the instrument is a single pole device and must not be used as the disconnect device. An IEC320 coupler is intended as the main disconnect device. The switch is marked I and O. The I indicates on and the O indicates off. Do not position the instrument such that access to the coupler is impaired.

Before switching on this instrument, make sure that the line supply voltage is in the specified ranges. Range selection is automatic.

As the IEC320 coupler is the disconnect device, consideration must be given to the following when installing the instrument in a rack:

- An adequately rated switch (250V, 10A) or circuit breaker (250V, 5A) shall be included in the rack.
- It should be in close proximity to the instrument and within easy reach of the operator.
- It shall be marked as a disconnect device.

Power Cable

WARNING

To avoid the possibility of injury or death, the following precautions must be followed before the instrument is switched on:

(a) While this is a Class I product, provided with a protective earthing conductor in a power cord, an external protective earthing terminal has also been provided. This terminal is for use where the earthing cannot be assured. At least an 18AWG earthing conductor should be used in such an instance, to ground the instrument to an assured earth terminal. The external protective earth terminal is on the rear of the instrument.

(b) If this instrument is to be energized via an auto-transformer to reduce or increase the line voltage, make sure that the common terminal is connected to the neutral pole of the power source.

(c) The power cable plug shall only be inserted into a socket outlet provided with a protective ground contact. The protective action must not be negated by the use of an extension cord without a protective conductor (grounding).



Figure 1 Earthing terminal - rear panel

The power cord supplied with each instrument varies with the country of destination. The following figure illustrates the standard power plug and cord configurations that are commonly used. The part number shown beneath each plug is the part number of the appropriate power cord and plug. If the appropriate power cord is not included with the instrument notify the nearest Agilent office and a replacement will be provided.

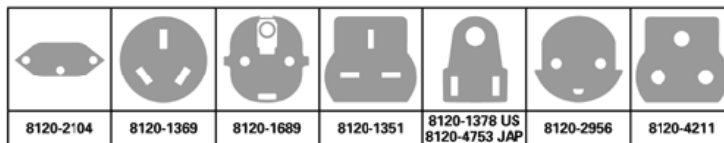


Figure 2 Power cable configurations and part numbers

Removing the Instrument Covers

The instrument covers are a press-fit. To remove them, gently lever them off.

When transporting the instrument, always replace both covers to protect the instrument connectors and display.

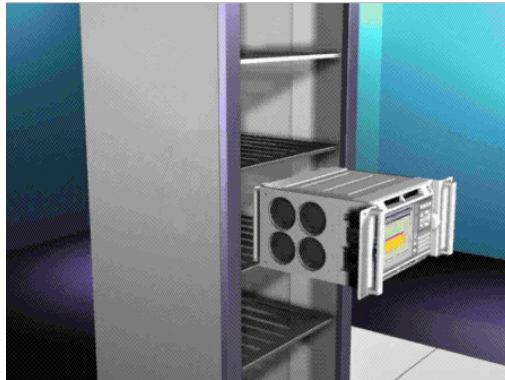
Useful Information When Requesting Support

When contacting Agilent Technologies for support it is useful to have the following instrument information available:

- Model Number.
- Serial Number. (on instrument base plate in the format GBXXXXXXXXXX)
- Instrument Options. (Press <Menu>, choose **System** > **Options** then press <Select>.)
- Instrument Firmware Revision. (Press <Menu>, choose **System** > **Options** then press <Select>. Select the **Software** tab.)
- Self Test fail codes and messages. (Press <Menu>, choose **System** > **Self Test** then press <Select>.)

Rack Mounting the Instrument

Option 005 of the instrument is ready to mount directly into a rack. All the hardware required is supplied with this version of the instrument.



Item (all supplied)	Part Number
Shelf	46101-00146
Captive Nuts (8 off) - for mounting shelf and instrument	0590-0804
Screws (4 off) - for mounting shelf	2680-0103
Dressed Screws (4 off) - for mounting instrument	0570-1366

► To rack mount the instrument

- 1 Fit the rack shelf supplied with the instrument to the rack, following the instructions given with the shelf.
- 2 Fit captive nuts (4 off, supplied) to rack uprights.
- 3 Place instrument on shelf.
- 4 Connect power cord and GP-IB cable (if required) **before** sliding the instrument into its final position on the shelf.

2 Installation (Getting Started)

- 5** Fit the screws (4 off, supplied) through the flanges into the captive nuts and tighten to a torque setting of 2 Nm.

Operation Checks on Delivery

The following procedures give a quick Power-up and Back-to-Back functional test of the optical interfaces using the optical accessories provided. These checks should be performed by a user or engineer familiar with making optical interface connections.

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 test failure or damage to the optical receivers.

▶ To power-up the instrument

- 1 For information on how to use the instrument and navigate the graphical user interface, refer to the **Quick Reference Guide** (supplied with the instrument).
- 2 Connect the OmniBER OTN to the AC Power Line using the Power Cord provided and set OmniBER OTN power switch ON (located beside power inlet).
- 3 The fans should start and after a few seconds the display will initialize and indicate the following.

Starting Instrument

Please wait.....

The Agilent Technologies splash screen will then be displayed while the unit completes initialization.

- 4 On completion (approximately 30 seconds), the display will change to the user windows with instrument settings. The Instrument is now ready for use.

NOTE

While running the instrument, a single line of text appears at the bottom of the display. This gives you helpful information relating to the area of the screen that is highlighted. In addition, online help is available on the instrument. If you require assistance at any time press the **<Help>** button on the front panel. This will display the online help.

To return to the normal instrument display press the **<Help>** button again.

Recalling Default Settings

▶ To ensure instrument is set to a known state

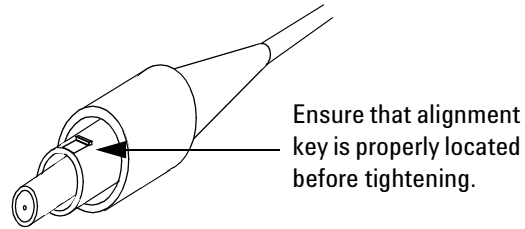
- 1 Press **<Menu>**, choose **Tx/Rx > Stored Settings** then press **<Select>**.
- 2 Select **Default** then **Recall**.
- 3 Select **OK** then wait for a few seconds for instrument to reconfigure to the default settings. Recall has completed when the dialog box clears.
- 4 Select **Close**.
- 5 Proceed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

Back-to-Back Functional Checks

The supplied Optical Patch Cord and 15 dB Optical Attenuator assembly are used to make an optical connection between the Transmit and Receive Ports for these checks.

Remove any dust protectors from the ends of Patch Cord and Attenuator before fitting and make sure the (white) exposed ends are not touched by fingers or otherwise become contaminated.

When making connections ensure full location in port key/notch then tighten/lock by hand depending on the connector type.

**WARNING**

Always ensure Optical Output Laser LEDs beside ports are OFF while making/changing optical connections.

Also refer to **"Laser Warnings and Cautions"** on page 21.

► To perform back-back functional check

- 1 Connect the OmniBER OTN as shown below.

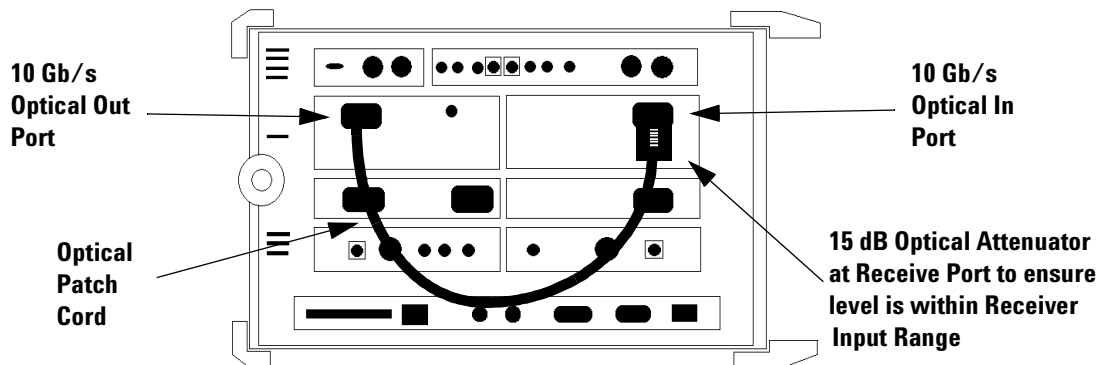


Figure 3 9.95 Gb/s (and 10.71 Gb/s) Loopback Connection

- 2 Press **<Menu>**, choose **Tx/Rx > Transmitter Settings** then press **<Select>**. Select the **Physical** tab. Set **Laser ON**. This enables the 10.71 Gb/s OTN Output. Displayed Transmitter

2 Installation (Getting Started)

Settings should be similar to example below. If the OTN capability is not fitted to the instrument follow [step 3](#) then skip to [step 7](#) to test the instrument at OC-192 instead.

The screenshot shows a configuration menu with three sections: Signal, Line, and Clock. The Signal section has Mode set to OTN and Rate set to OTU2. The Line section has Interface set to Optical, Wavelength set to 1550nm, and a checkbox for Laser On which is checked and highlighted with a red box. The Clock section has Source set to Internal and Format set to 2Mb/s Clock.

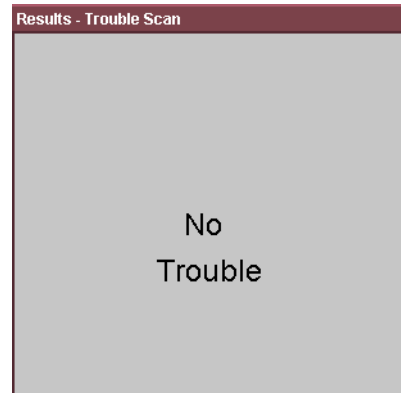
Check the laser LED is illuminated at the 9.95/10.71 Gb/s Output Port on the OmniBER OTN's connector panel.

- 3 Press **<Menu>**, choose **Tx/Rx > Coupling** then press **<Select>**. Choose **Copy Tx to Rx** to set Coupling On. Select **Close** to close dialog.

The screenshot shows a dialog box titled "Tx / Rx - Coupling". It contains two buttons at the top: "Copy Tx to Rx" and "Copy Rx to Tx". In the center, the text "Coupling On" is displayed. Below this text is a button labeled "Switch Coupling Off". At the bottom of the dialog is a button labeled "Close", which is highlighted with a red box.

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

- 5 Check that '**No Trouble**' is displayed in the **Results** window to confirm no errors have been detected. If not then refer to "[What to Do if the Test Fails](#)" on page 48.



- 6 Press <**Single Error**> button and check that the Errors Led flashes red and some errors accumulate on the **Results - Trouble Scan** window. Then press the <**Run/Stop**> key to stop gating.
- 7 Change the Transmitter Settings **Signal Mode** to **SONET**, **Signal Rate** to **OC-192**.

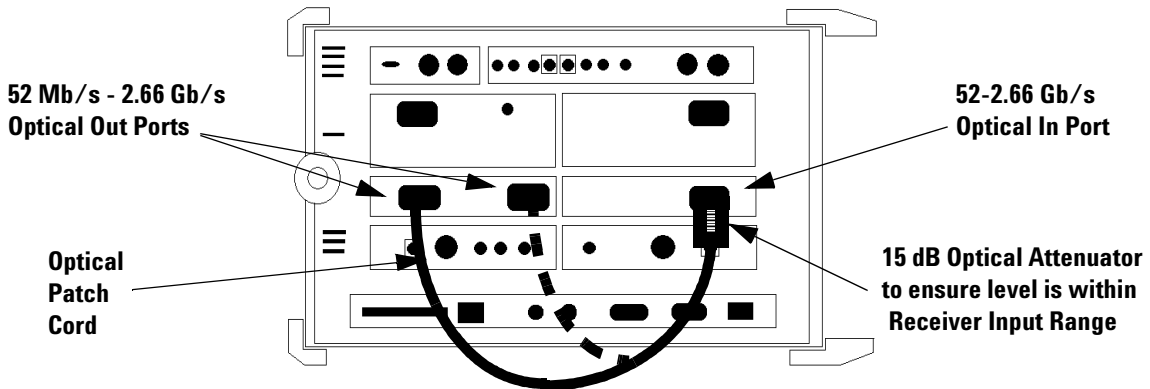
NOTE

The Receiver will automatically set to the same Signal Rate if the Transmitter as Tx > Rx Coupling is On. The graphical display on lower window indicates the overall set-up of Transmitter & Receiver. Coupling status is shown in left lower corner.

- 8 Check the laser LED is illuminated at the 9.95/10.71 Gb/s Output Port on the OmniBER OTN's connector panel.
- 9 Repeat [step 4](#) to [step 6](#) to confirm correct operation.
- 10 Press <**Window**> key to highlight the **Transmitter Settings** page and set the **Laser** to **OFF**.

2 Installation (Getting Started)

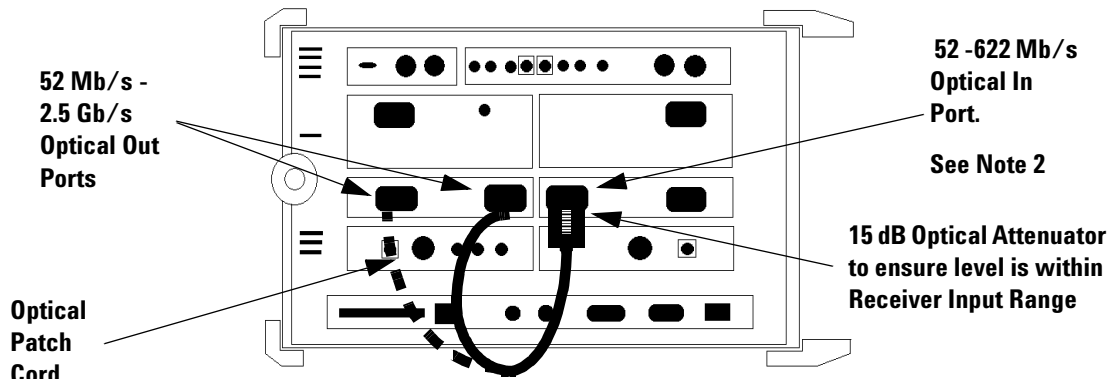
11 Change/Make the following Optical loopback connection to check the 2.5 Gb/s interface as shown in [Figure 4](#).



Note - Either of the [52Mb/s - 2.5Gb/s] Transmitter Outputs may be used if both 1310 and 1550 nm ports are fitted.

Figure 4 2.5 Gb/s Loopback Connection

- 12** Change the Transmitter Settings **Signal Rate** to **OC-48** and set the **Wavelength** to be the same as the Transmit Port connected in set-up, i.e. **1310nm** or **1550nm**.
- 13** Set the **Laser** to **ON** and check the laser LED is illuminated at the connected 52Mb/s-2.66Gb/s Output Port on the OmniBER OTN's connector panel.
- 14** Repeat [step 4](#) to [step 6](#) to confirm correct operation.
- 15** Change the Transmitter Setting **Signal Rate** to **OTU-1**
- 16** Repeat [step 4](#) to [step 6](#) to confirm correct operation.
- 17** Press <Window> key to highlight the **Transmitter Settings** page and set the **Laser** to **OFF**.
- 18** If the instrument has a single Receiver port covering the range 52 Mb/s to 2.66 Gb/s skip this step and resume at [step 20](#). If the instrument has two separate Receiver ports; 52 Mb/s - 622 Mb/s and 2.5 - 2.66 Gb/s continue with [step 19](#).
- 19** Change the Optical loopback connection to check the 622 Mb/s and below interface as shown in [Figure 5](#).



Note 1 - Either of the [52Mb/s - 2.5Gb/s] Transmitter Outputs may be used if both 1310 and 1550 nm ports are fitted.

Note 2 - The 52 - 622 Mb/s Receiver port may be combined with the 2.5Gb/s Receiver port. Separate ports were only supplied on initial units. Connect the cables accordingly.

Figure 5 622 Mb/s Loopback Connection

- 20** Change the Transmitter Settings **Signal Rate** to **OC-12** and set the Wavelength to be the same as the Transmit Port connected in set-up.
- 21** Set the **Laser to ON** and check the laser LED is illuminated at the connected 5 2Mb/s - 2.5 Gb/s Output Port on the OmniBER OTN's connector panel.
- 22** Repeat [step 4](#) to [step 6](#) to confirm correct operation.
- 23** Press <Window> key to highlight the **Transmitter Settings** window and set the **Laser to OFF**.
- 24** Disconnect all loopback connections.

What to Do if the Test Fails

NOTE

Always ensure Optical Output Laser LEDs beside ports are OFF while making/changing optical connections.

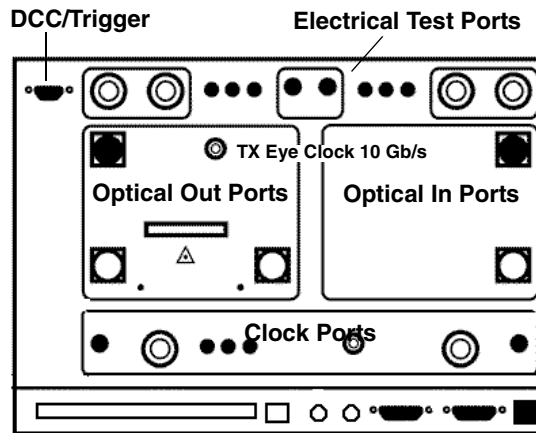


What to do if test fails

- 1 Check all connections and make sure that the correct loopback connection is in place for the interface being checked. Make sure connectors are located in key/notch of the port connectors to ensure full insertion.
- 2 Check Transmitter and Receiver are set to the same Signal Rate and that the correct Laser is On when test is being Run.
- 3 Press <Smart Test>, choose **Shortcuts > Optical Power** then press <Select>. Check the Received signal level is in the Green BER measurement power range.
- 4 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
- 5 Power down unit and use recognized cleaning kit to clean connectors before retrying the Tests.

If the problem persists then contact your local Agilent Sales/Service representative.

Side Panel Connectors



Optical Out Ports

The Optical Out Ports provide OTN signals at 2.66 Gb/s and 10.71 Gb/s and SONET optical signals OC-1, OC-3, OC-12, OC-48, OC-192, and SDH optical signals STM-0, STM-1, STM-4, STM-16, STM-64 at wavelength 1310 and 1550 nm, depending on instrument model and options.

52 Mb/s - 2.66 Gb/s 1310 nm Selectable optical connector (see table below) for a 52 Mb/s to 2.66 Gb/s optical output. Nominal wavelength is 1310 nm. Power output is -5 to +0 dBm.

52 Mb/s - 2.66 Gb/s 1550 nm Selectable optical connector (see table below) for a 52 Mb/s to 2.66 Gb/s optical output. Nominal wavelength is 1550 nm. Power output is -2 to +3 dBm.

9.95/10.71 Gb/s, 1550 nm Selectable optical connector (see table below) for a 9.95 Gb/s or a 10.71 Gb/s optical output. Nominal wavelength is 1550 nm. Power output is -1 to +1 dBm.

Optical In Ports

The Optical In ports accept OTN signals at 2.66 Gb/s and 10.71 Gb/s, SONET OC-1, OC-3, OC-12, OC-48 and OC-192 and SDH STM-0, STM-1, STM-4, STM-16, STM-64 signals, depending on the model and options fitted.

52 - 2.66 Gb/s Selectable optical connector (see table below) for a 52 Mb/s to 2.66 Gb/s optical input (OC-1, OC-3, OC-12, OC-48, OTU1/STM-0, STM-1, STM-4, STM-16 signals). Wavelength 1200 to 1600 nm. Input damage power $>+3$ dBm; never exceed maximum input power. The recommended input power operating level for OC-1, OC-3/STM-0, STM-1 signals is -33 to -10 dBm and for OC-12/STM-4 and OC-48/STM-16/OTU1 signals is -28 to -8 dBm.

9.95/10.71 Gb/s Selectable optical connector (see table below) for 9.95/10.71 Gb/s (OC-192/STM-64/OTU2) optical input signals. Wavelength 1290 to 1565 nm. Input damage power $>+1$ dBm; never exceed maximum input power. The recommended input power operating level for OTU2/OC-192/STM-64 signals is -18 to -7 dBm for 9.95 Gb/s and -16 to -7 dBm for 10.71 Gb/s.

Connector	Option
FC/PC Adapters fitted on all optical interfaces	609
SC Adapters fitted on all optical interfaces	610
ST Adapters fitted on all optical interfaces	611

Clock Ports

TX Eye Clock 9.95 Gb/s and 10.71 Gb/s SMA connector providing a TX Eye Clock signal (at 1/16 of the line rate) which can be used to trigger an oscilloscope when examining data signals.

DS1 Clock In Bantam 100 ohm (nominal) connector for a DS1 BITS external reference clock input.

2 Mb/s, 2 MHz, 10 MHz Clock In BNC 75 ohm (nominal) unbalanced connector for a 2 Mb/s and 2 MHz MTS external clock source input. You can also use this connector to input a 10 MHz clock reference.

2 Mb/s, 2 MHz Clock In 3-pin Siemens connector for a 2 Mb/s and 2 MHz MTS external clock source input.

TX Eye Clock 52 - 2.66 Mb/s SMA connector providing a TX Eye Clock signal (at 1/4 of the line rate) which can be used to trigger an oscilloscope when examining data signals.

2 MHz Clock Out BNC 75 ohm (nominal) unbalanced connector for a 2 MHz MTS clock reference output. Generated relative to the selected transmit reference clock.

DS1 Clock Out Bantam 100 ohm (nominal) connector for a DS1 BITS clock reference output. Generated relative to the selected transmit reference clock.

DCC/GCC Port/Trigger Port

Connector 9-pin miniature D-type.

Use this port to drop and insert OTN GCC channels (OTU GCC0, ODU GCC1, ODU GCC2), the D1-D3 DCC channel or the D4-D12 DCC channel. This port is also used to output transmitter and receiver triggers. The first bit of data inserted will be put into the MSB of the DCC channel. The MSB of the dropped data bytes will be output first. The drop and insert capabilities are independent, that is the transmit and receive clock rates can be set to different rates. Note that the instrument acts as a DCE (Data Communications Equipment), supplying the clock signal for both drop and insert operation.

Pin Number	DCC/GCC	Triggers
1	Rx Data Output (+)	Transmit trigger output (+)
2	Rx Clock Output (+)	Receive trigger output (+)
3	Signal ground	Signal ground
4	Tx Clock Output (+)	Fixed level
5	Tx Data Input (+)	Not used
6	Rx Data Output (-)	Transmit trigger output (-)
7	Rx Clock Output (-)	Receive trigger output (-)
8	Tx Clock Output (-)	Fixed level
9	Tx Data Input (+)	Not used

Rate D1-D3 DCC: 192 kb/s, D4-D12 DCC: 576 kb/s, OTU/ODU GCCO/GCC1/GCC2: 1.3124 Mb/s.

DCC/GCC Port Input Termination 100 ohms differential. The DCC port to BNC trigger connector accessory only uses the positive side of the differential trigger signal. A 50ohm serial resistor is incorporated into the cable and it is recommended that to maintain voltage levels the signal is terminated with 1 Mohm in the oscilloscope or other equipment.

Input Sensitivity 200 mV over a common mode input voltage range from -0.3V to 5.5V.

Output Level Logic '1' = 2.3 V typical; Logic '0' = 0.8 V typical

Electrical Test Ports

SONET/SDH Out BNC 75 ohm unbalanced connector for an STS-1/STM-0 (B3ZS) or STS-3/STM-1 (CMI) electrical output.

SONET/ SDH In BNC 75 ohm unbalanced connector for an STS-1/STM-0 (B3ZS) or STS-3/STM-1 (CMI) electrical input. Input Mode - Terminate or Monitor. Monitor mode conforms to G.772-1993. Monitor Gain - 20 or 26 dB.

2 Mb/s Out 3-pin Siemens 120 ohm balanced connector for an E1 Transmit or E1 Drop signal output. Either this port or the 2-140 Mb/s, DS3 unbalanced Out port can be active for the E1 Transmit function.

2 Mb/s In 3-pin Siemens 120 ohm balanced connector for an E1 Receive or E1 Insert signal input. Either this port or the 2-140 Mb/s DS3 unbalanced In port can be active for the E1 Receive function.

DS1 Out Bantam 100 ohm balanced connector for a DS1 Transmit or DS1 Drop signal output.

DS1 In Bantam 100 ohm balanced connector for a DS1 Receive or DS1 Insert signal input.

2-140 Mb/s DS3 Out BNC 75 ohm unbalanced connector for E1, E2, E3, E4, DS3 transmit or E1, E3, E4, DS3 Drop signals. Either this port or the 2 Mb/s balanced Out port can be active for the E1 Transmit function.

2-140 Mb/s DS3 In BNC 75 ohm unbalanced connector for E1, E2, E3, E4, DS3 receive or E1, E3, E4, DS3 Insert signals. Either this part or the 2 Mb/s balanced In port can be active for E1.

Connectors at Base of Side Panel

The following descriptions describe the connectors as they appear from left to right. (Note that on some options the following connectors may be on the rear of the instrument.)

Floppy Disk Drive Accepts 1.44 Mb IBM formatted disks.

USB Two Universal Serial Bus ports for connecting to a printer. The printer may be attached after power-on.

Mouse PS/2 port for connecting a mouse.

Keyboard PS/2 port for connecting an external keyboard. Can be hot-plugged for use at any time. Ensure that keyboard port is used - if connected to mouse PS/2 port in error the instrument will require to be restarted.

RS232 Remote Control port providing following configurations:

- **Controller Type:** Computer and Terminal.
- **Protocol:** None and Xon/Xoff.
- **Speed:** 300, 600, 1200, 1800, 2400, 4800, 9600, 19200 baud.
- **Parity:** Odd, Even, 1s, 0s.
- **Stop Bits:** 1, 2
- **Data Length:** 7 bits.

VGA Connector for displaying contents of instrument screen on an external display. Ensure that the external display is connected before powering up the instrument.

LAN 10M/100M 10/100 Base-T LAN interface port. Supports remote control of instrument and the downloading of firmware upgrades. Note that to ensure compliance with EN 55011 (1991) a category 5, STP patch lead, RJ45 cable should be used to connect to the LAN port.

Connectors on Instrument Rear Panel



GPIB Allows instrument to be remotely controlled via the GPIB control bus.

External Protective Earth Connect an external earth connection to the instrument at this point.

AC Power Connect the instrument power cord here and set the switch to 1 to turn on and to 0 to turn off.

Instrument Reboot (Cold Start)

An instrument “cold start” routine is provided to reset the instrument in the event of an unplanned hardware or firmware event. A cold start reboots the instrument and restarts the instrument using a default configuration file. Performing a cold start erases existing configuration information. Current menu settings will be lost and the instrument will power up in its default state.

▶ **To perform a cold start**

- 1 Switch the instrument off and wait a few seconds.
- 2 Switch the instrument on and as the instrument boots up, look carefully at the display.
- 3 Wait for the “Starting instrument” text to be displayed. After a few seconds start to repeatedly press the **<Menu>** key until the Agilent splash screen appears with an options menu in the top left corner of the display.

The following options are available:

- 3 Cold start.
- 5 Normal start.
- 4 Press 3 on the numeric keypad to select cold start. The unit will then continue with the boot up process.
- 5 When the boot-up procedure is complete, the instrument displays a dialog box with the message: “Instrument reset to default settings.”



3 Performance Tests

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Introduction

The procedures given in this Section test the performance of the Agilent J7230A OmniBER OTN 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 59. 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 141. 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 approximately 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, Wavelength 1260 - 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 opt 100 (option 100 provides E2625A Communication Mask test kit)
Termination Adaptor Probe	Balanced 110/120 ohms to unbalanced 50 ohms	E2621A
Adaptor	75/50 ohms unbalanced	E2622A
Patch Cable	Bantam 110 ohms	15670A
Patch Cable	Siemens 3-pin 120 ohms	15512A
75Ω Termination	0 to 200 MHz	15522-80010
T Connector	BNC to Dual BNC	1250-0781
Adaptor	BNC(m) to SMA(f)	E9632A

3 Performance Tests

Instrument	Critical Specification	Recommended Model
Cable	SMA to SMA	8120-4948
Balanced/Unbalanced Converter	110 Ω balanced: 75 Ω Unbalanced (nominal)	15508B

Self Test Loopback Cables and Accessories

- 1005-0337 1m fiber optic patchcord FC/PC connectors.
- 1005-0433 15 dB optical attenuator FC/PC.
- 15525A 75 ohm BNC cable, 2 off.
- 15512A Siemens 3-pin cable.
- 15670A Bantam 110 ohm cable.
- 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.



To recall default settings

- 1 Press **<Menu>**, choose **Tx/Rx > Stored Settings** then press **<Select>**.
- 2 Select **Default** then **Recall**.
- 3 Select **OK** in the Warning box and then wait a few seconds for instrument to reconfigure to the default settings. The recall is complete when the Warning box disappears.
- 4 Select **Close** in 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.

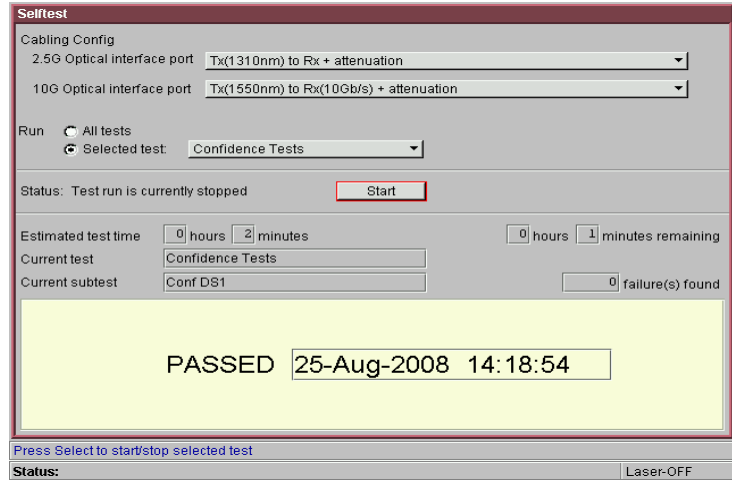
This section gives an description of the Self Tests that are required to be completed as part of the Performance Tests and covers the following

- 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 6](#) on page 65).

Optical Loopback Connections (Required on all instruments)

Use optical cables P/N 1005-0337 and 15 dB attenuator P/N 1005-0433

- Connect 9.95/10.71 Gb/s Optical Out <> 15 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
- Connect 52 Mb/s-2.5 Gb/s Optical Out <> 15 dB Attenuator <> 52 Mb/s-622 Mb/s Optical In

Electrical connections SONET/SDH 52 Mb/s to 155 Mb/s (Required on all instruments)

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 3-pin Siemens cable P/N 15512A and Bantam cable P/N 15670A

- Connect 2M Out (3-pin Siemens) <> 2M In
- Connect DS1 Out <> DS1 In

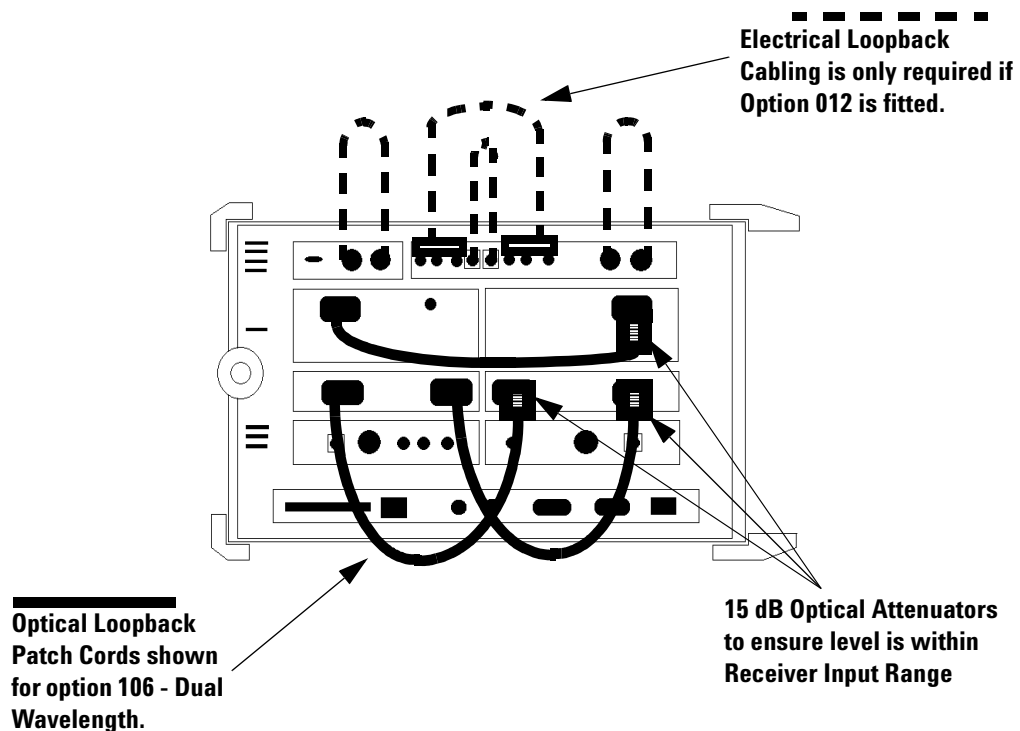


Figure 6 Self Test Loopback Connections

NOTE

Some instruments have a single, combined Optical In port for the range 52 Mb/s - 2.66Gb/s. Connect the cabling accordingly.

Where the number of Optical Transmitters fitted does not match the number of Optical Receivers fitted the Self Test should be re-cabled and re-run to verify all Transmitters and Receivers. 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



To run 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

- ▶ **What to do if 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 DS_n 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 DS_n 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

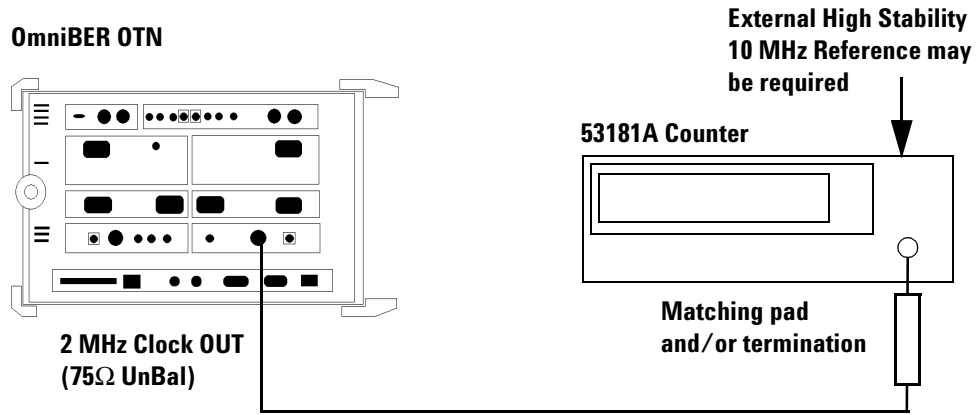
For accuracy required the counter **MUST** have high stability Internal Timebase option or be externally referenced to an in-house Standard.



To test the internal clock reference accuracy

- 1** Press <Menu>, choose **Tx/Rx** > **Stored Settings** then press <Select>. Select **Default** then **Recall**.
- 2** Press <Menu>, choose **Tx/Rx** > **Transmitter Settings** then press <Select>. Select the **Physical** tab. 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.

3 Performance Tests



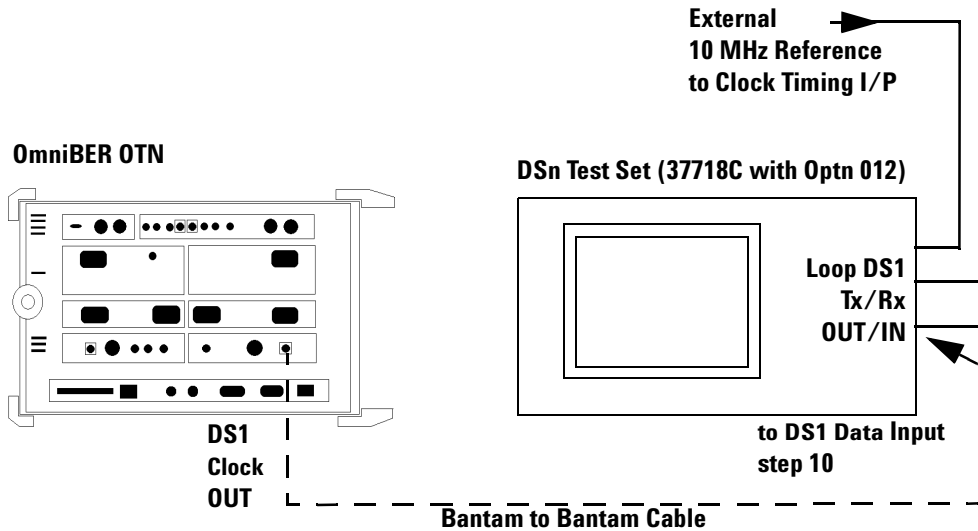
- 4 Adjust the Frequency Counter Trigger Level to obtain a stable reading and check that the Frequency Counter reads between:

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** then press **<Select>**. Select the **Physical** tab. 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 Alarms/Errors indicated by the Test Set Receiver.

NOTE

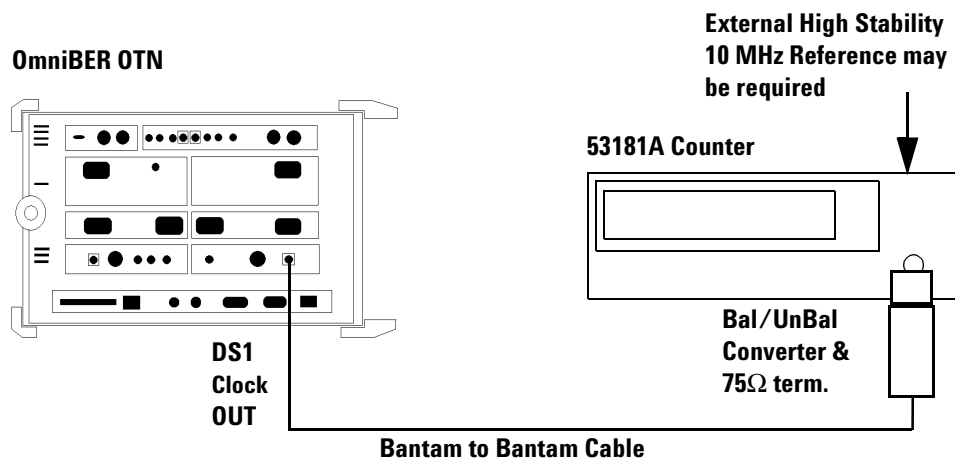
If the Test Set CLOCK LOSS LED is ON check the external reference signal.

- 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 Alarms/Errors 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 Complete.

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

► To perform alternative DS1 clock test

- 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

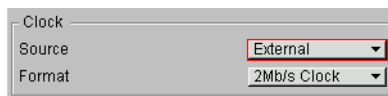
For accuracy required the counter MUST have high stability Internal Timebase option or be externally referenced to an in-house Standard.

► To test the external clock reference inputs and output

(External 2M Clock as Reference)

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

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

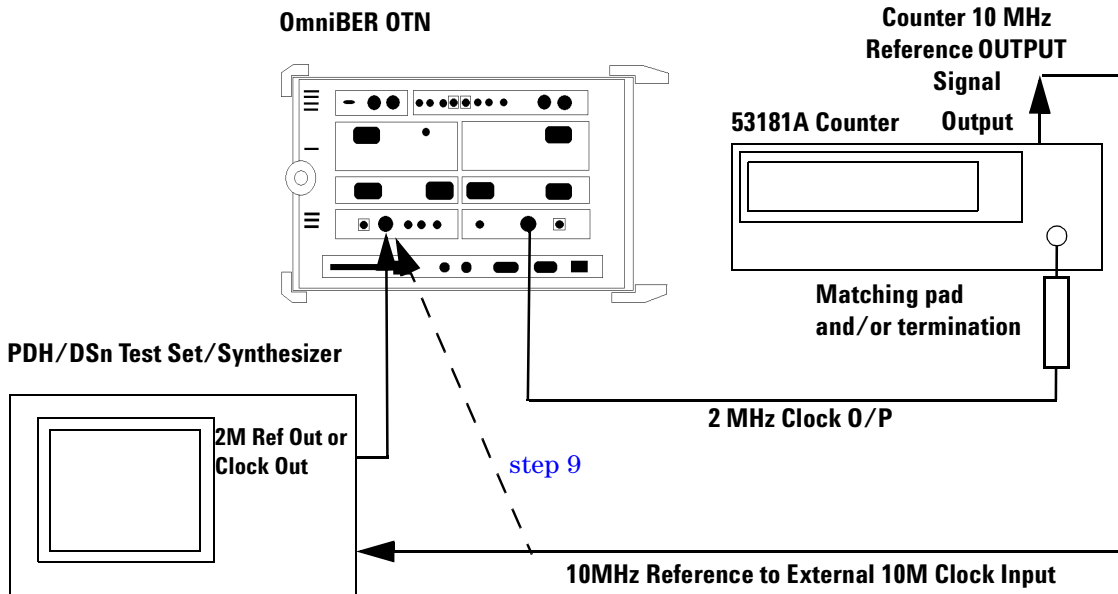


- 3 Connect the OmniBER OTN's 2 MHz Clock Out port to the Frequency Counter Input using a 75/50Ω matching pad, set the input impedance to 50Ω. Alternatively, a 75Ω termination can be used with the input impedance set to 1MΩ.

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

3 Performance Tests

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



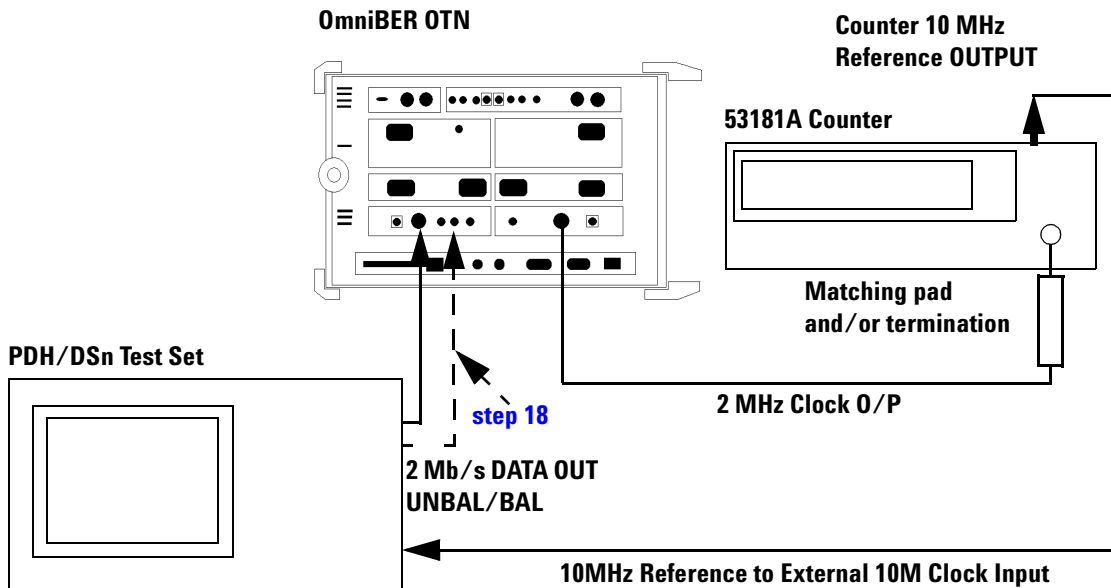
- 4 Set the PDH/DSn Test Set Transmitter as follows.
SIGNAL to 2 Mb/s rate
CLOCK to EXTERNAL 10 MHz REF
- 5 Check that the PDH/DSn Test Set CLOCK LOSS Alarm Led is not lit.
- 6 Adjust the Frequency Counter Trigger Level to obtain a stable reading and check that the Frequency Counter reads between:
2.047999999 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 2²³ 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 Balanced 3 pin Siemens cable between the Test Set Data OUT 3-pin port and OmniBER OTN CLOCK IN 3-pin port.

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.

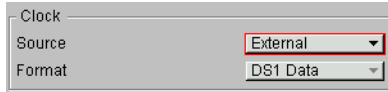
2.047999999 MHz and 2.048000001 MHz

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.

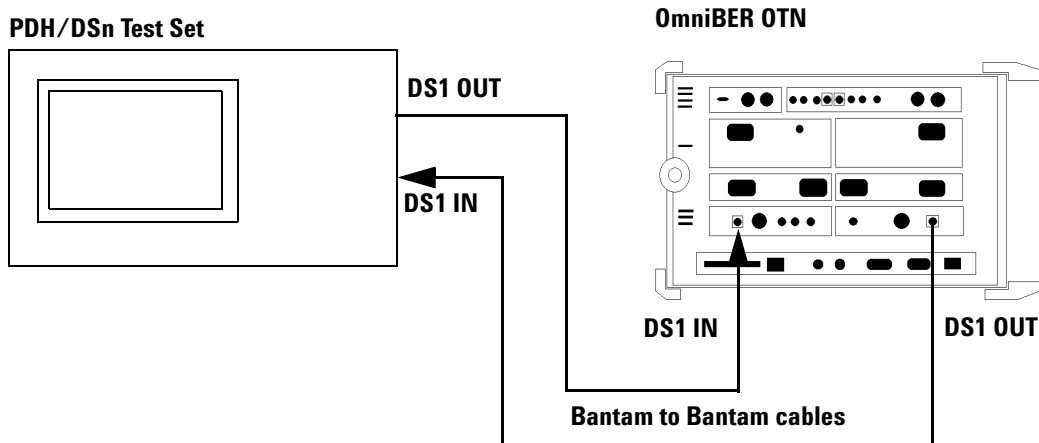
(External DS1 Balanced Data as Reference)

23 Press <Menu>, choose Tx/Rx > **Transmitter Settings** then press <Select>. Select the **Physical** tab. 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

3 Performance Tests

PATTERN to ALL ONES

26 Check there are no ALARMS/ERRORS 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 Complete.

Optical Pulse Mask and Output Characteristics

Specifications

Optical Output Power

1310 nm	-5 to +0 dBm *
1550 nm (<=2.66 Gb/s)	-2 to +3 dBm *
1550 nm (9.95/10.71 Gb/s)	-1 to +1 dBm * (version 1)
1550 nm (9.95/10.71 Gb/s)	-5 to -1 dBm * (version 2)

* Typical transmit power level is in the middle of the stated range.
Check the stated Output Power on the instrument panel to determine if the instrument has version 1 or version 2 optics fitted

Extinction ratio	>8.2 dB
-------------------------	---------

Pulse mask	Meets ITU-T G-957 (6/1999) and Telcordia GR-253-CORE Issue 3 (9/2000)
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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-1 and 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/comms/omniberotn> under the heading "Software and Drivers"

52/155 and 622 Mb/s Optical Output Checks

- ▶ **To test the OC-1/STM-0 power level and eye mask**
 - 1** Press <Menu>, choose **Tx/Rx > Stored Settings** then press <Select>. Select **Default** then **Recall**.
 - 2** Press <Menu>, choose **Tx/Rx > Transmitter Settings** then press <Select>. Select the **Physical** tab. 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**.

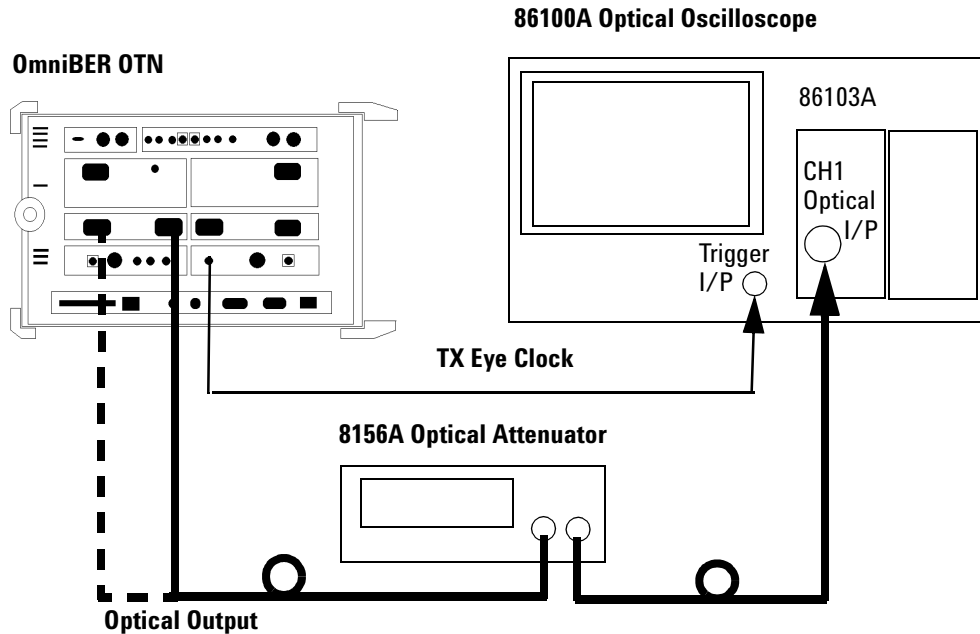
Signal	
Mode	SONET
Rate	OC-1
Line	
Interface	Optical
Wavelength	1310nm
	<input type="checkbox"/> Laser On
Clock	
Source	Internal
Format	DS1 Data

- 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.

3 Performance Tests



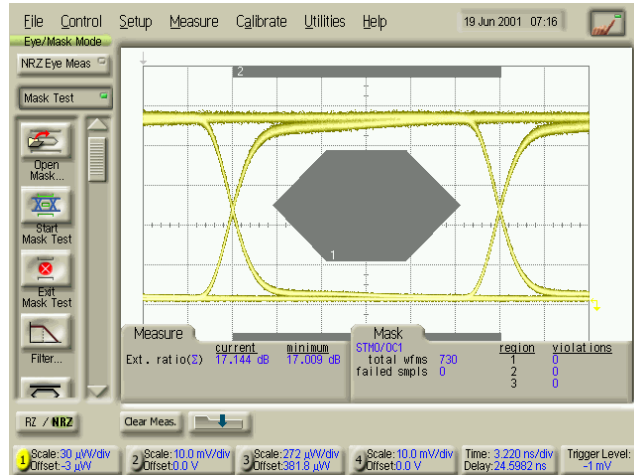
- 4 Set OmniBER OTN **Laser** to **ON** and set Optical Attenuator to **Enable**.
- 5 On the oscilloscope select **Setup > Channel 1 > Advanced settings**. Switch oscilloscope Channel 1 ON, set it to the correct optical wavelength for the signal being tested and set **Mask Filter** to **OC-3 (156Mb/s), 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.

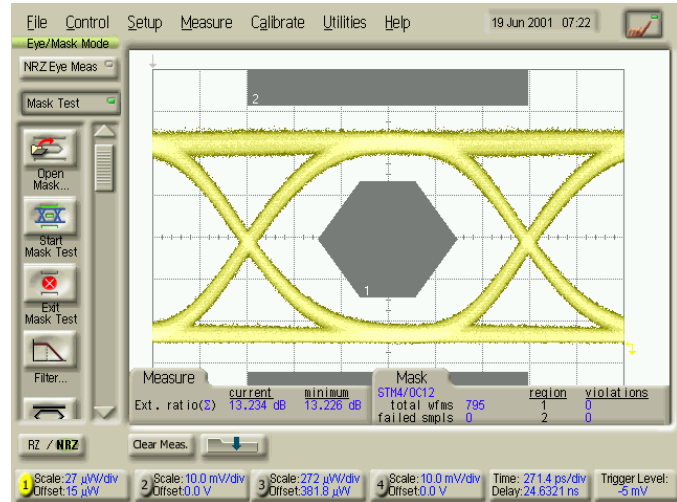
► To test the OC-3/STM-1 power level and eye mask

- 12 Change the OmniBER OTN Signal Rate. Press **<Menu>**, choose **Tx/Rx > Transmitter Settings** then press **<Select>**. Select the **Physical** tab. 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 87](#).
- 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.

▶ **To test the OC-12/STM-4 power level and eye mask**

- 19 Change the OmniBER OTN Signal Rate. Press <Menu>, choose **Tx/Rx > Transmitter Settings** then press <Select>. Select the **Physical** tab. 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 87](#).
- 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.

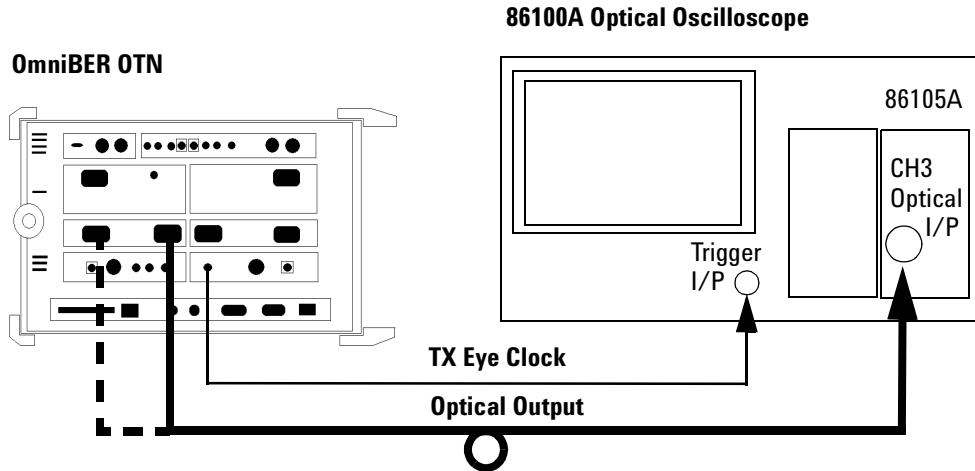


OC-12/STM-4 Eye Mask

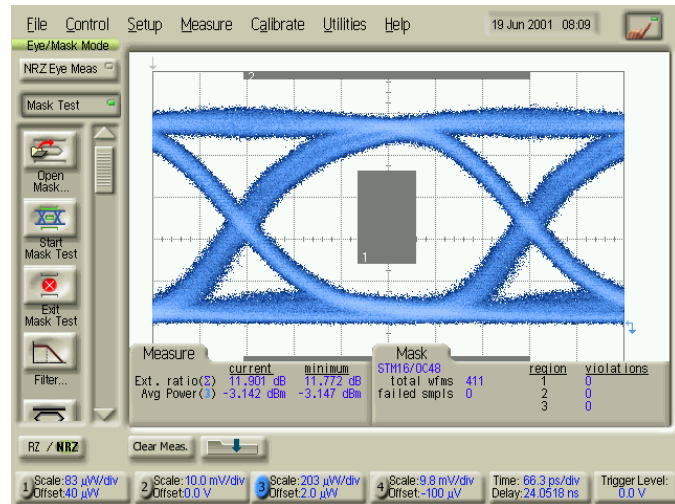
2.5 Gb/s and 2.66Gb/s Optical Output Checks

- ▶ **To test the OC-48/STM-16 power level and eye mask**
- 26** Change the OmniBER OTN Signal Rate. Press <Menu>, choose **Tx/Rx > Transmitter Settings** then press <Select>. Select the **Physical** tab. 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.

3 Performance Tests



- 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 89](#).



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:

-5 dBm to +0 dBm (for 1310 nm)

-2 dBm to +3 dBm (for 1550 nm)

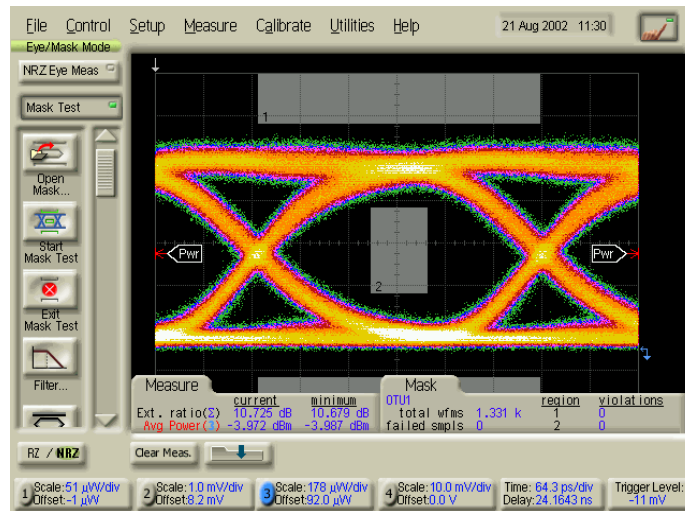
- 36** Check the Extinction Ratio is greater than **8.2 dB** and record the measured value.

3 Performance Tests

► To test the OTU-1 power level and eye mask (opt 111 only)

37 Set the OmniBER OTN **Signal Mode** to **OTN** and the **Signal Rate** to **OTU-1** and repeat [step 33](#) through [step 36](#) with the OTU-1 mask loaded into the scope.

38 Check that the output meets the mask as shown below



OTU-1 Eye Mask

39 If the instrument has Dual Wavelength option (1310 and 1550 nm ports) for 51 - 2.66 Gb/s, repeat [step 1](#) through [step 38](#) 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

► To test the OC-192/STM-64 power level and eye mask

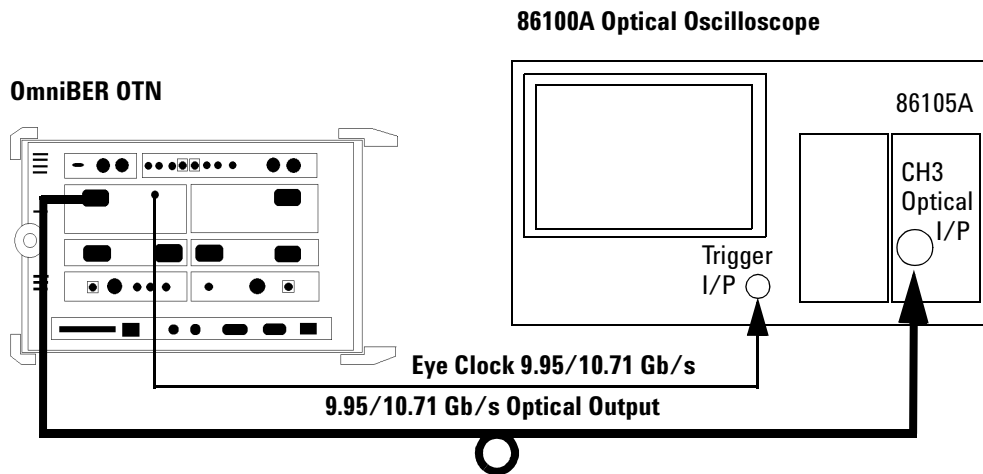
1 Press <Menu>, choose **Tx/Rx > Stored Settings** then press <Select>. Select **Default** then **Recall**.

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

to **SONET** and **Signal Rate** to **OC192**. Ensure the **Laser** is set to **OFF**.

Signal	
Mode	SONET
Rate	OC-192
Line	
Interface	Optical
Wavelength	1550nm
<input type="checkbox"/> Laser On	
Clock	
Source	Internal
Format	DS1 Data

- 3** Connect the **9.95/10.71 Gb/s Optical Out Port** to the oscilloscope using an Optical Patch cord. Also 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

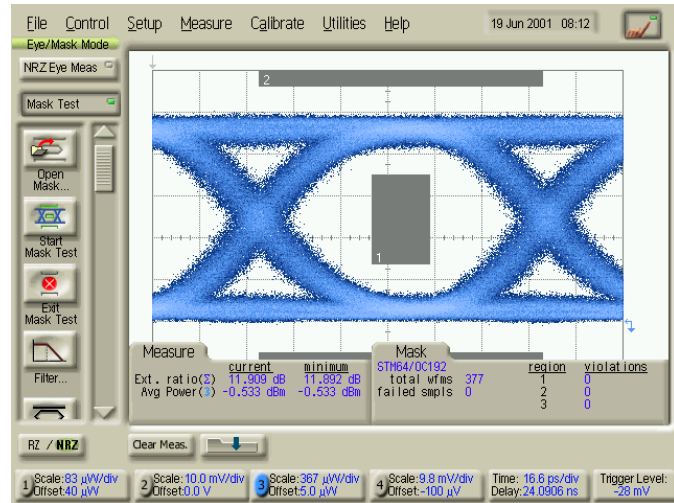
signal being tested and set **Mask Filter** to **OC-192 (9.95Gb/s)**, **ON**,

- 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 93
- 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 +1 dBm** for version 1 optics OR **-5 to -1 dBm** for version 2. (To determine if the instrument has version 1 or version 2 optics fitted check the stated Output Power on the instrument connector panel.)
 - 11** Check the Extinction Ratio is greater than **8.2 dB** and record the measured value.



OC-192/STM-64 Eye Mask

► To test the 10.71 Gb/s (OTU2) power level and eye mask (option 112 only)

12 Set the Transmitter display as shown below.

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

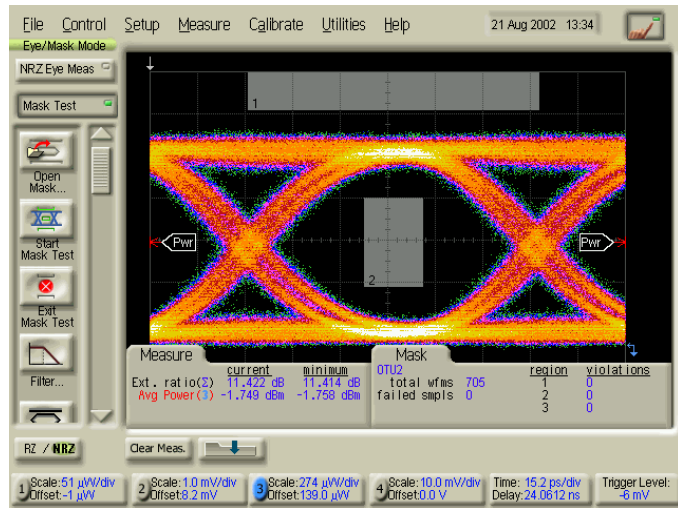
Signal	
Mode	OTN
Rate	OTU2
Line	
Interface	Optical
Wavelength	1550nm
	<input type="checkbox"/> Laser On
Clock	
Source	Internal
Format	DS1 Data

- 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 95](#).
- 18** 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.

- 19** Check the Average Optical Power is between **-1 to +1 dBm** for version 1 optics OR **-5 to -1 dBm** for version 2. Check the Extinction Ratio is greater than **8.2 dB** and record the measured value.
- 20** Tests Complete. Set the Laser to OFF before disconnecting setup.



OTU-2 Eye Mask

Optical Receiver Sensitivity, Optical Power and Frequency Measurement

Specifications

Min. sensitivity
(Note1):

52/155 Mb/s	-34 dBm
622 Mb/s	-28 dBm
2.5 Gb/s	-28 dBm
2.66 Gb/s	-26 dBm
9.95 Gb/s ;	-18 dBm (version 1)
	-14 dBm (version 2)
10.71 Gb/s ;	-16 dBm (version 1)
	-14 dBm (version 2)

Max. input power
(Note1):

52/155 Mb/s	-10 dBm
622 Mb/s	-9 dBm
2.5 Gb/s	-9 dBm
2.66 Gb/s	-9 dBm
9.95 Gb/s & 10.71 Gb/s;	-10 dBm (version 1)
	-1 dBm (version 2)

Note 1;

52 Mb/s – 2.66 Gb/s; for BER = 1×10^{-10} (input signal extinction ratio ≥ 8.2 dB).

9.95 Gb/s & 10.71 Gb/s; for BER = 1×10^{-12} (input signal extinction ratio ≥ 8.2 dB).

Check the stated Optical 10G Output Power on the instrument panel to determine if the instrument has version 1 or version 2 optics fitted;

Version 1 has a 10G Optical Output Power of +1 dBm Max.

Version 2 has a 10G Optical Output Power of -1 dBm Max

Optical power measurement	<p>Supported for all optical receive rates.</p> <p>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.</p> <p>Accuracy: 10 Gb/s: ± 1.5 dB. 2.5 Gb/s: ± 2 dB. 622 Mb/s and below: ± 1 dB.</p> <p>Resolution: 0.1 dB.</p>
Line frequency measurement	<p>Supported for all optical and electrical receive rates.</p> <p>Results: Frequency (MHz), Offset (Hz and ppm).</p> <p>Accuracy: ± 4.5 ppm.</p> <p>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.</p>

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

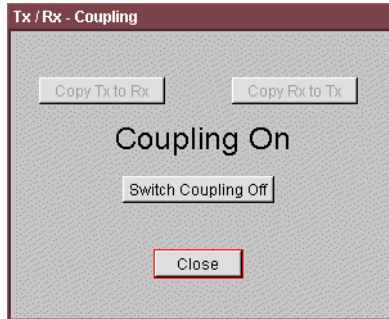
WARNING

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:

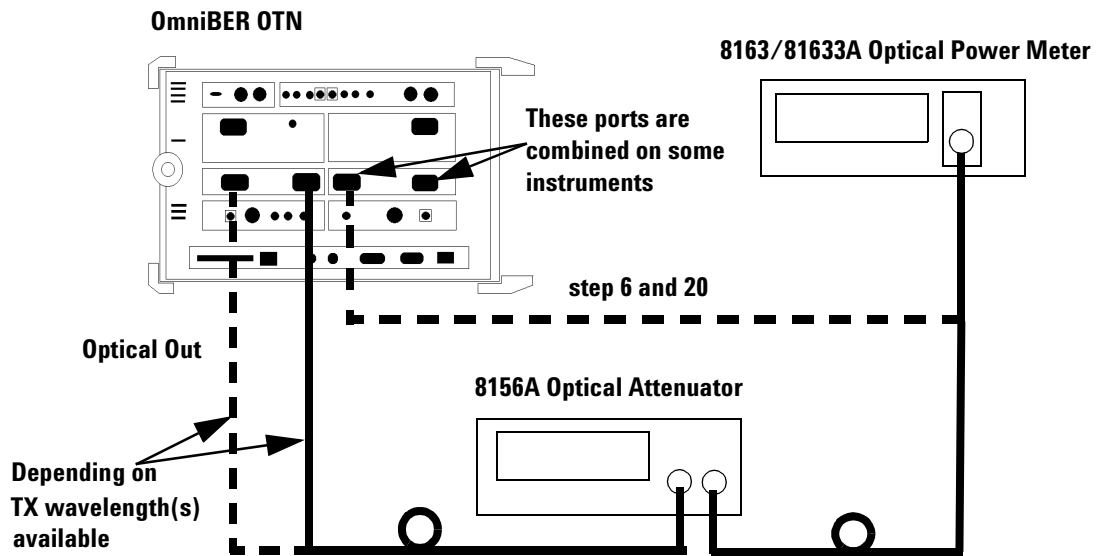
- Check the connector configuration of the Fiber Optic Interfaces. If non FC/PC connectors are fitted then remove them, then fit the FC/PC connector interface.
- Check for any damage to the OmniBER OTN's Fiber Optic Interface spring loaded aperture covers and connectors. Do not power up the instrument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

► To test the OC-1/STM-0 and OC-3/STM-1 rates

- 1 Press <Menu>, choose **Tx/Rx** > **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** then press <Select>. Select the **Physical** tab. 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.

The screenshot shows a configuration menu with the following settings:

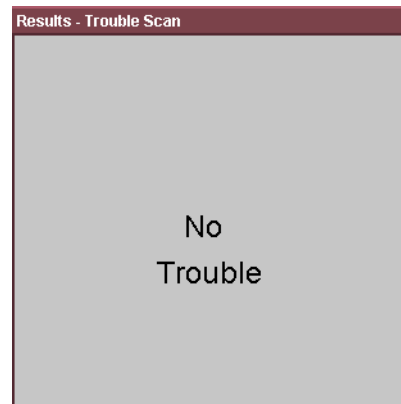
- Signal**
 - Mode: SONET
 - Rate: OC-1
- Line**
 - Interface: Optical
 - Wavelength: 1310nm
 - Laser On
- Clock**
 - Source: Internal
 - Format: DS1 Data

- 6 Adjust the Optical Attenuator to obtain a reading of -33 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 3 dB (that is, providing –30 dBm output).

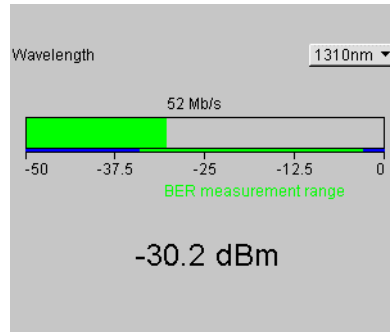
Set the OmniBER OTN's Receiver to display **Optical Power** as follows:

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

3 Performance Tests

Check that the optical power measurement reads between:

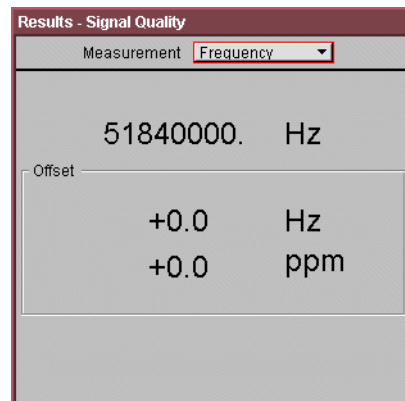
-31 dBm and -29 dBm



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](#).

▶ **To test the OC-12/STM-4 rates**

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

Press **<Menu>**, choose **Tx/Rx > Transmitter Settings** then press **<Select>**. Select the **Physical** tab. 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 19 dB and check the Receiver **Optical Power** result is between:

-10 dBm and -8 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.

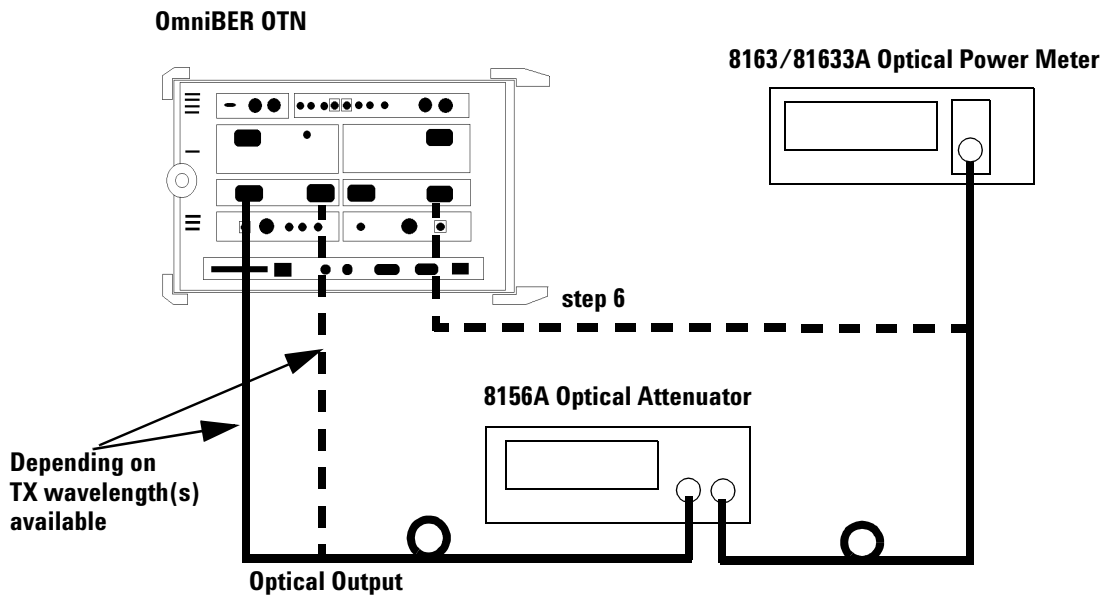
27 Check the Power Meter reading is between:

-9.5 dBm and -8.5 dBm

► **To test the OC-48/STM-16 rates**

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

2 Connect the test setup as shown below, depending on wavelengths installed:



3 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).

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

Press **<Menu>**, choose **Tx/Rx > Transmitter Settings** then press **<Select>**. Select the **Physical** tab. 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.

- 5 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.
- 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 (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.

- 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 -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

- 11** Reduce the Optical Attenuator setting by a further 19 dB and check the Receiver **Optical Power** result is between:

-11 dBm and -7 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:

-9.5 dBm and -8.5 dBm

► To test the OTU-1 (2.66 Gb/s) rate (Not available on all options)

- 15** Set the OmniBER OTN Transmitter to provide an OTU-1 output with PRBS bulk payload as follows:

Press <Menu>, choose **Tx/Rx** > **Transmitter Settings** then press <Select>. Select the **Physical** tab. Set the **Signal Mode** to **OTN** and **Signal Rate** to **OTU-1**.

16 Adjust the Optical Attenuator to obtain a reading of -26 dBm on the Power Meter (that is, the Receiver minimum sensitivity for 2.66 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 (2.66 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 Set 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 -26 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:

-28 dBm and -24 dBm

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

2666.0570 MHz and 2666.0572 MHz

22 Reduce the Optical Attenuator setting by a further 17 dB and check the Receiver **Optical Power** result is between:

-11 dBm and -7 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:

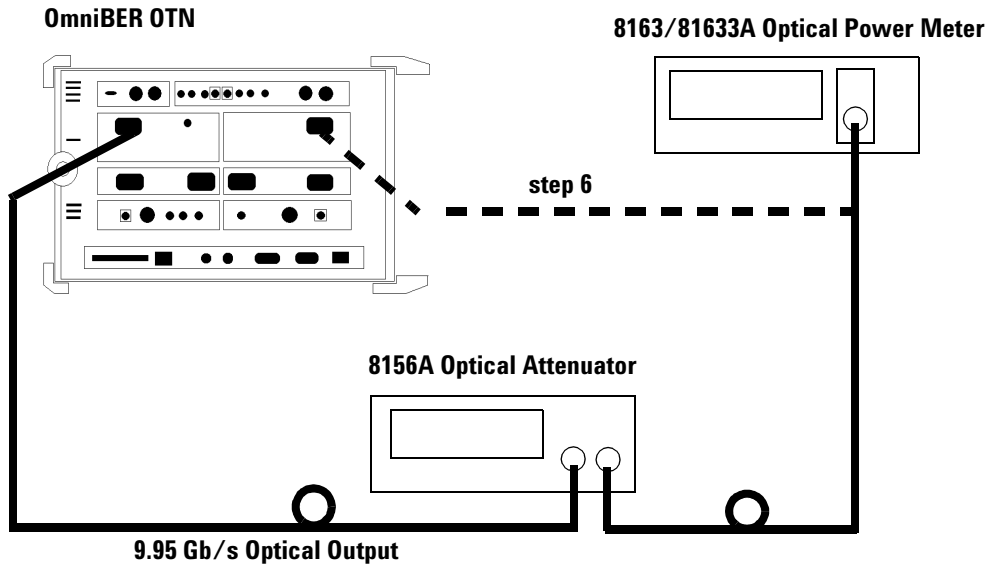
-9.5 dBm and -8.5 dBm

▶ **To test the OC-192/STM-64 rates**

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

2 Connect the test setup as shown below.

3 Performance Tests



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** then press **<Select>**. Select the **Physical** tab. 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 -14 dBm on the Power Meter. 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 -14 dBm output).

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

-15.5 dBm and -12.5 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

► **To test the OTU-2 (10.71 Gb/s) rate (Not available on all options)**

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

Press <Menu>, choose **Tx/Rx** > **Transmitter Settings** then press <Select>. Select the **Physical** tab. 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.

- 12** Adjust the Optical Attenuator to obtain a reading of -14 dBm on the Power Meter. Take note of the Attenuator setting.

- 13** 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.

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

- 15** 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.

- 16** 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.

- 17** Re-set Optical Attenuator to the setting noted in [step 12](#) (providing -14dBm).

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

-15.5 dBm and -12.5 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

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

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
STXS-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

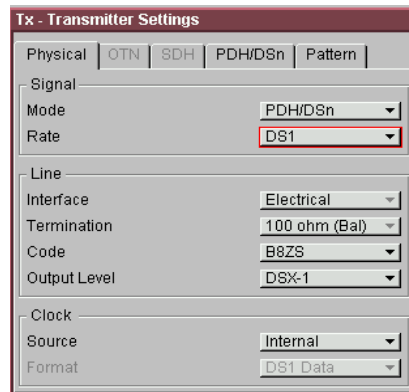
Oscilloscope	54810A with Option 100 Communication Mask Kit (E2625A)
Patch Cable	15512A Siemens 3 pin
Patch Cable	15670A Bantam 110 ohm
Adapter	E2621A Termination Adapter Probe

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.

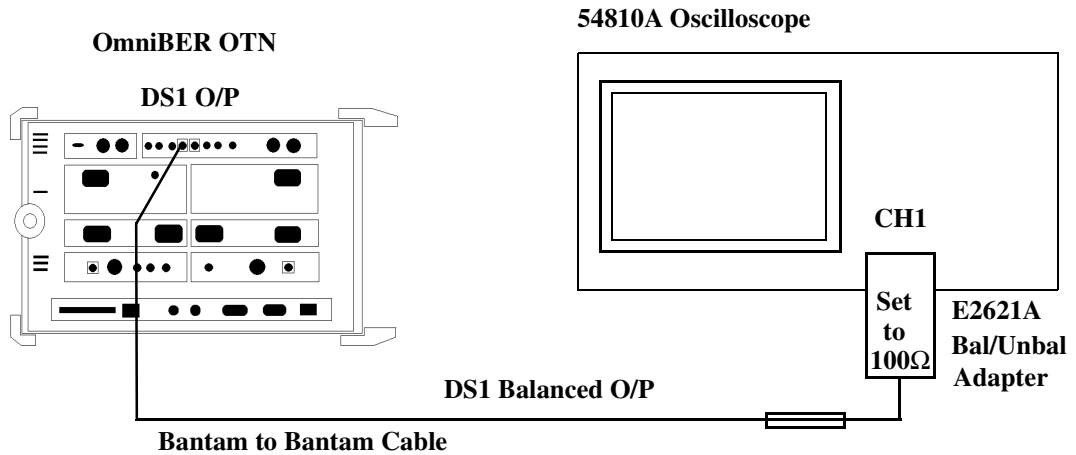
► To test the DS1 output pulse mask

- 1 Recall the OmniBER OTN's default settings as shown on "[Recall Default Settings](#)" on page 62.
- 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 Performance Tests

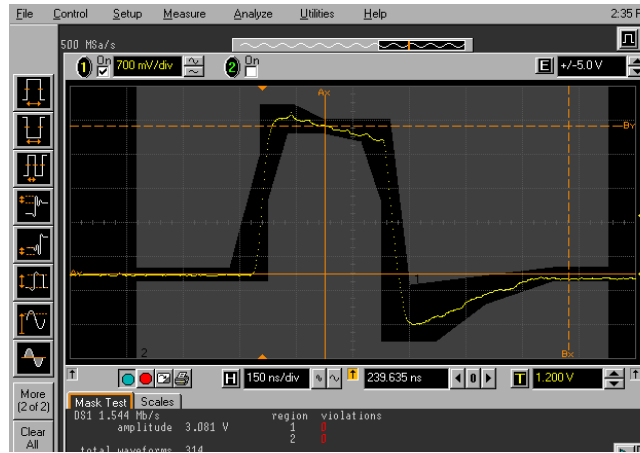
- 3 Connect the OmniBER OTN's **DS1 OUT** port to the Oscilloscope using the E2621A Termination Adapter Probe, set probe switch to **100Ω**.



- 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

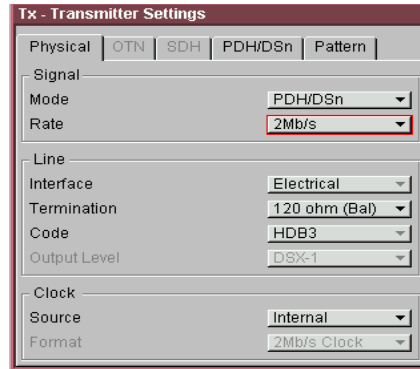
- 5 Check the DSX-1 pulse amplitudes are between 2.4-3.6V pk.
- 6 Set the instrument Output Level to DS-1-LO and check that the Pulse Output Amplitude decreases by approximately 20% and pulse shape has slower rise/fall edges.

NOTE

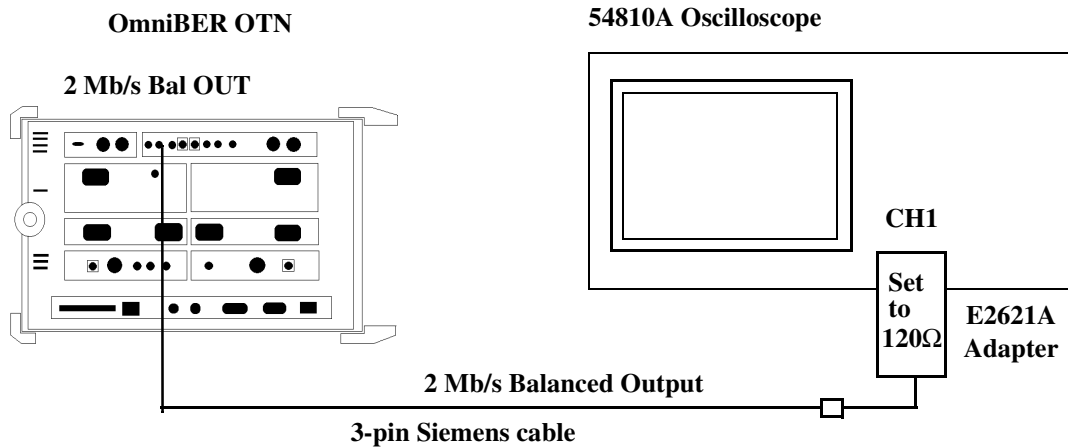
The DS1-LO Pulse mask test is not applicable to step 6 and the check is included to provide a functional confirmation of the LO selection.

► To test the 2 Mb/s balanced output pulse mask

- 1 Recall the OmniBER OTN's default settings as shown on "Recall Default Settings" on page 62.
- 2 Press <Menu>, select **Tx/Rx** > **Transmitter** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **2Mb/s**, **Termination 120 ohm (Bal)**.



- 3 Connect the **2 Mb/s BAL OUT** port to the Oscilloscope CHAN 1, using the E2621A Termination Adapter Probe, set probe switch to **120Ω**.

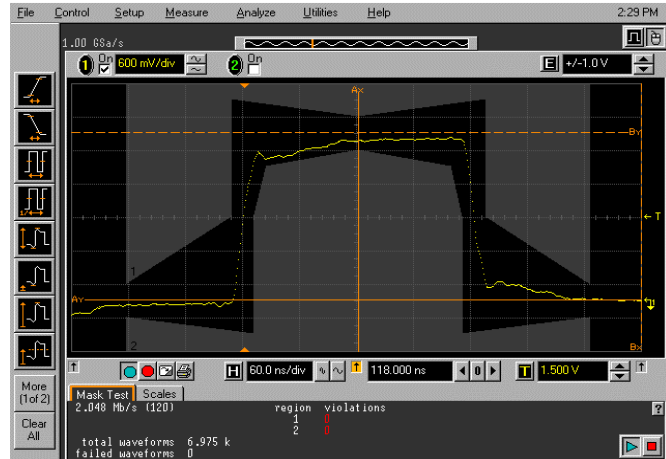


- 4 Load the **2Mb_ITU_120.msk** test mask and check the Positive and Negative pulses are within the mask (see examples).

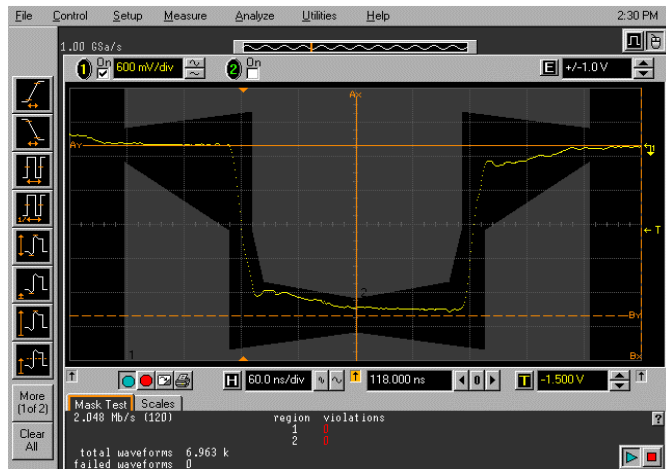
NOTE

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

3 Performance Tests



2M Balanced Positive Pulse

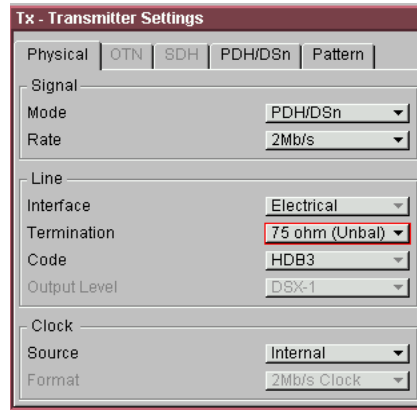


2M Balanced Negative Pulse

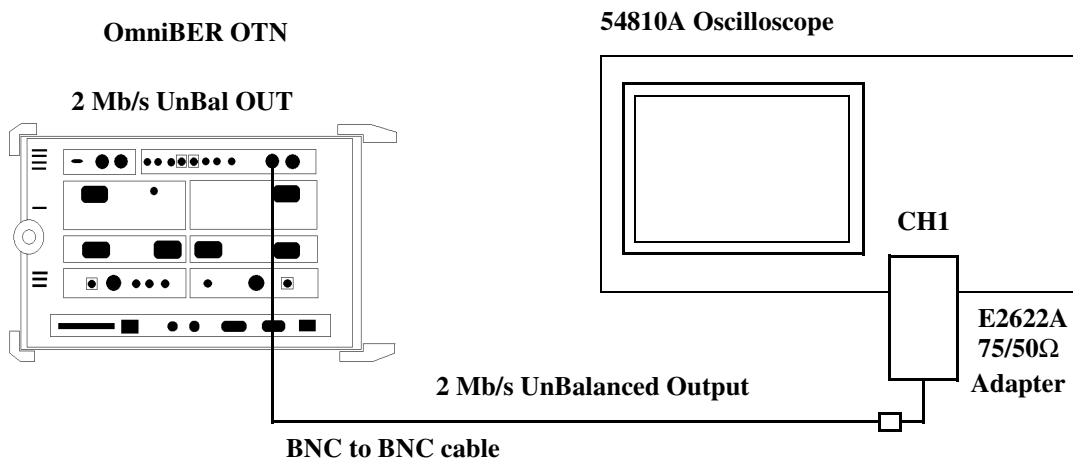
► **To test the 2 Mb/s unbalanced output pulse mask**

- 1 Recall the OmniBER OTN's default settings as shown on "[Recall Default Settings](#)" on page 62.

- 2 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)**.



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

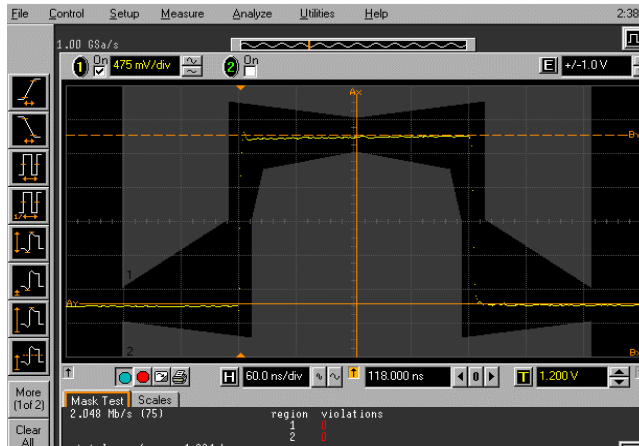


3 Performance Tests

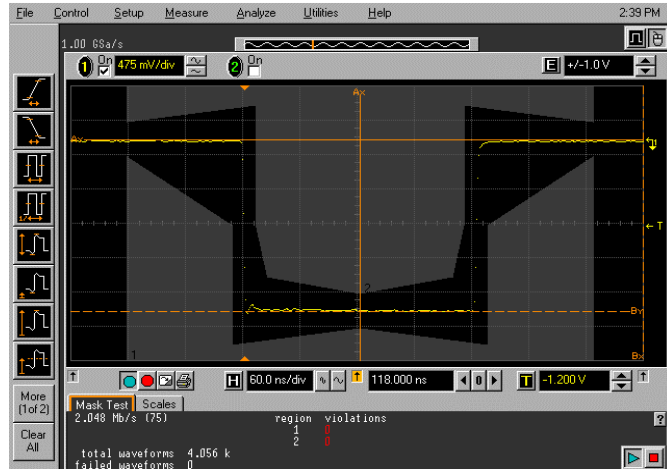
- 4 Load the **2Mb_ITU_75.msk** test mask and check the Positive and Negative pulses are within the mask (see examples).

NOTE

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



2M Unbalanced Positive Pulse

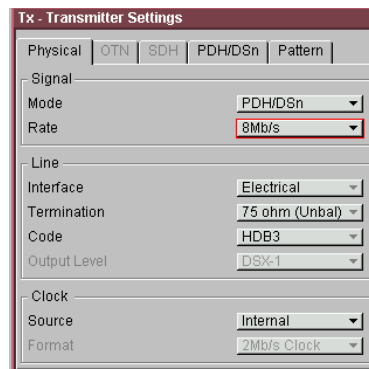


2M Unbalanced Negative Pulse



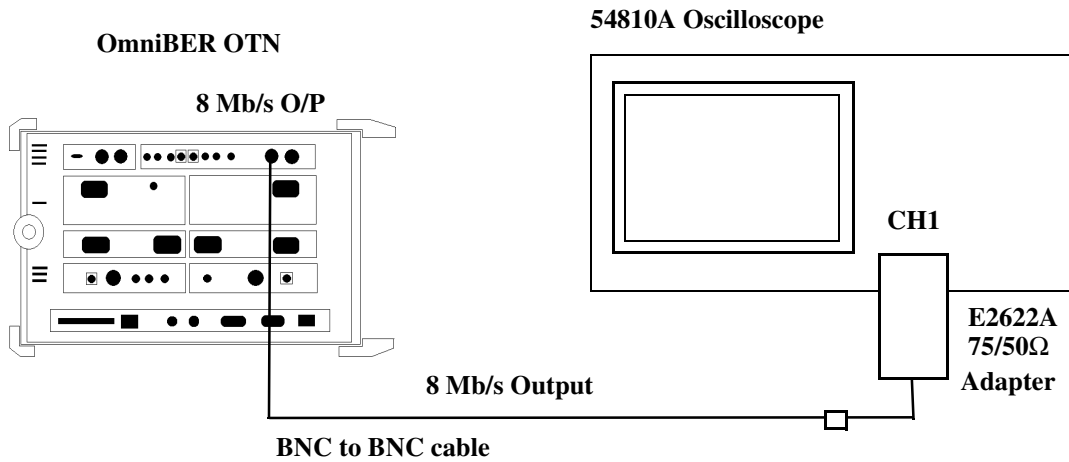
To test the 8 Mb/s output pulse mask

- 1 Recall the OmniBER OTN's default setting as shown on "[Recall Default Settings](#)" on page 62.
- 2 Press <Menu>, select **Tx/Rx > Transmitter Settings** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **8 Mb/s**.



3 Performance Tests

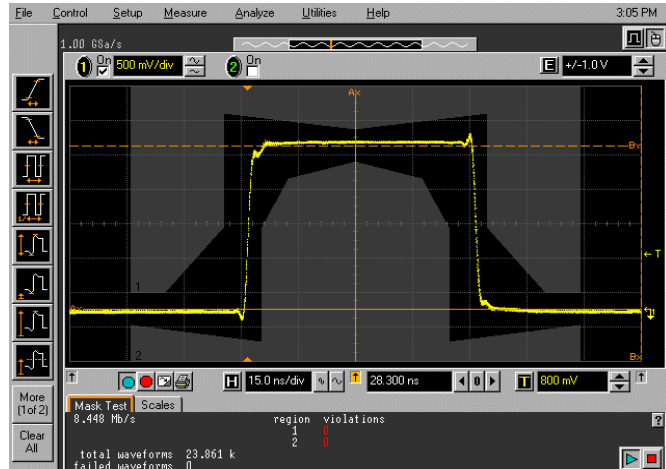
- 3 Connect the **8 Mb/s OUT** port to the Oscilloscope CHAN 1, using the E2622A Termination Adapter Probe.



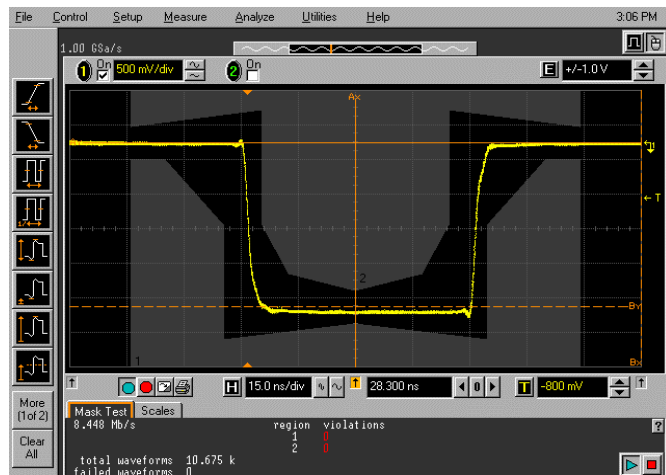
- 4 Load the **8Mb_ITU.msk** test mask and check the Positive and Negative pulses are within the mask (see examples).

NOTE

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



8M Unbalanced Positive Pulse



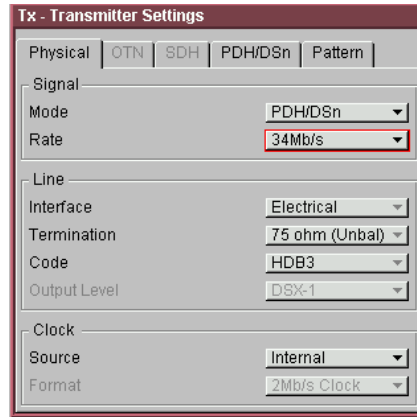
8M Unbalanced Negative Pulse

► **To test the 34 Mb/s output pulse mask**

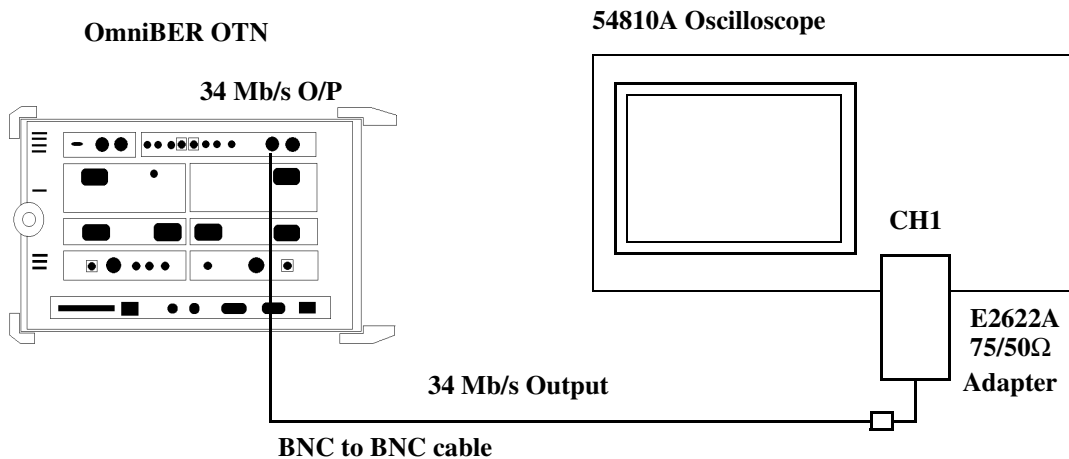
- 1 Recall the OmniBER OTN's default setting as shown on "[Recall Default Settings](#)" on page 62.

3 Performance Tests

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



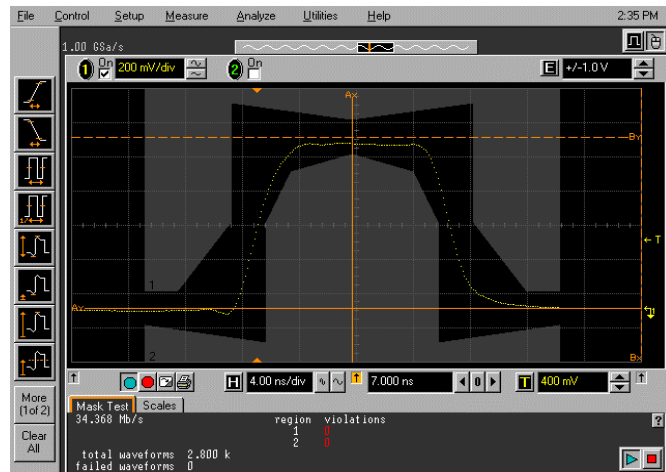
- 3 Connect the **34 Mb/s OUT** port to the Oscilloscope CHAN 1, using the E2622A Termination Adapter Probe.



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

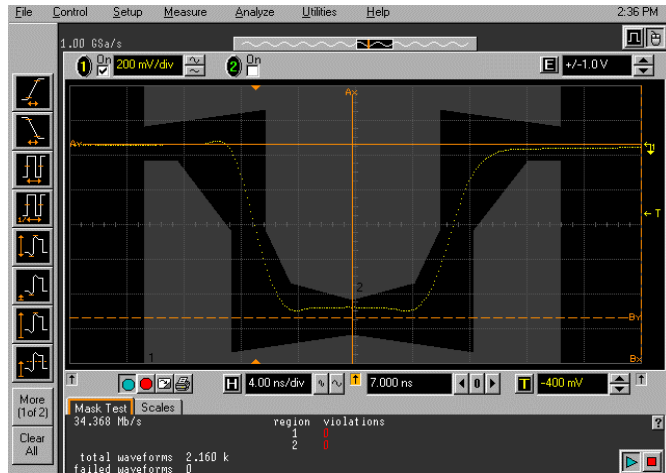
NOTE

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



34M Unbalanced Positive Pulse

3 Performance Tests

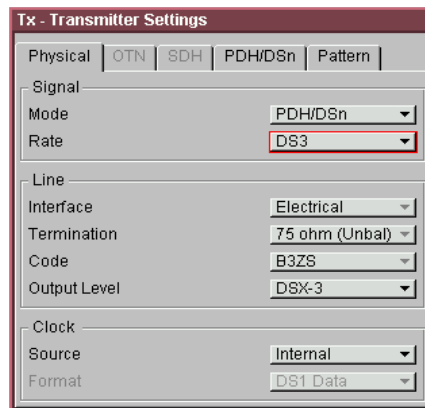


34M Unbalanced Negative Pulse

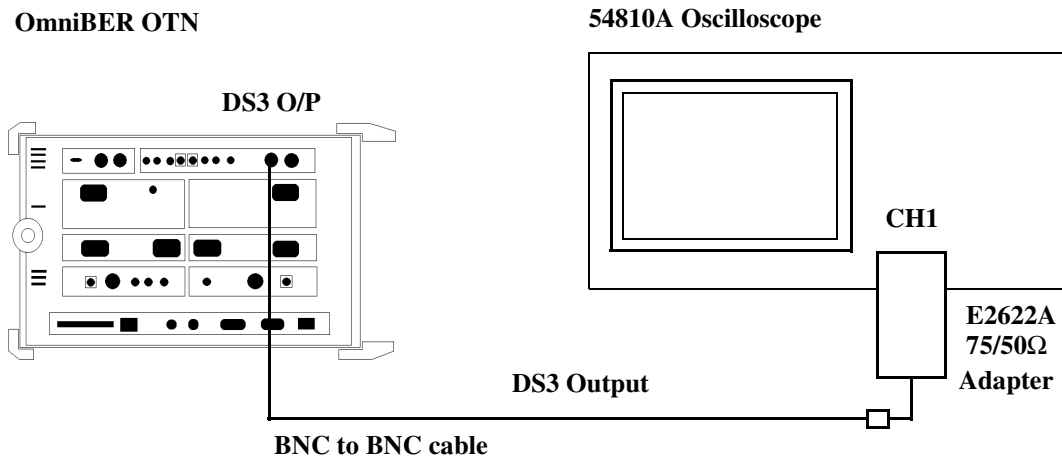


To test the DSX-3 output pulse mask

- 1 Recall the OmniBER OTN's default setting as shown on "[Recall Default Settings](#)" on page 62.
- 2 Press <Menu>, select Tx/Rx > **Transmitter Settings** and set the **Signal Mode** to **PDH/DSn**. Now set the **Signal Rate** to **DS3**.



- 3 Connect the **DS-3 OUT** port to the Oscilloscope CHAN 1, using the E2622A Termination Adapter Probe.

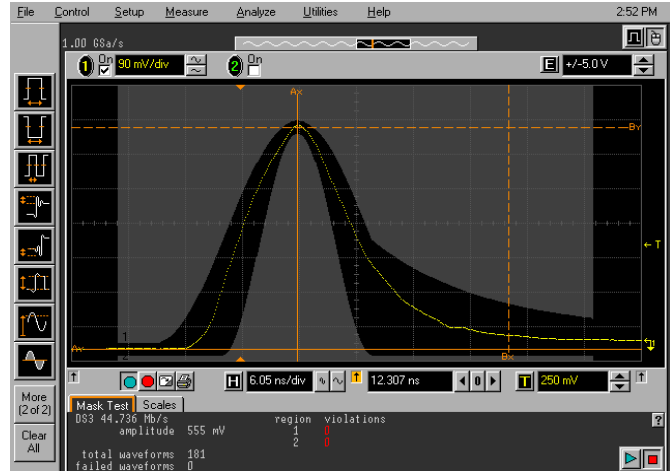


- 4 Load the **DS3_ANSI.msk** test mask and check the Positive and Negative pulses are within the mask (see examples).

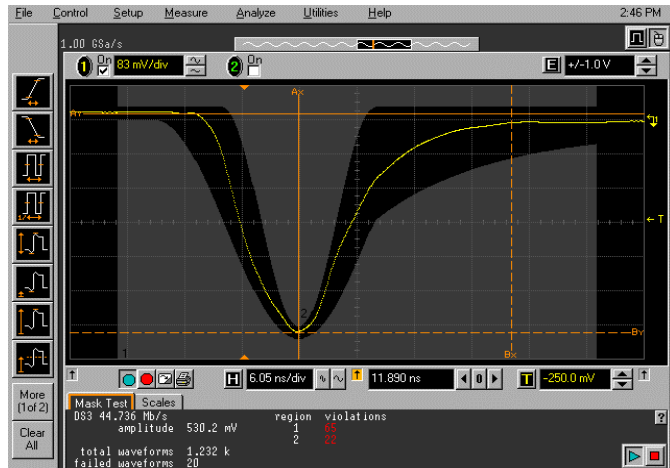
NOTE

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

3 Performance Tests



DSX-3 Positive Pulse

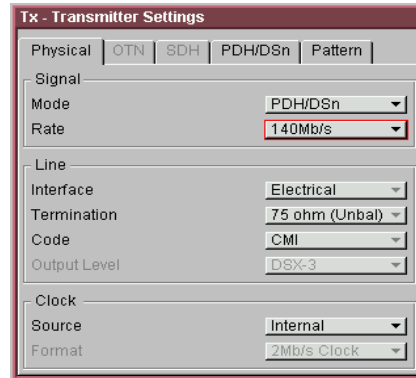


DSX-3 Negative Pulse

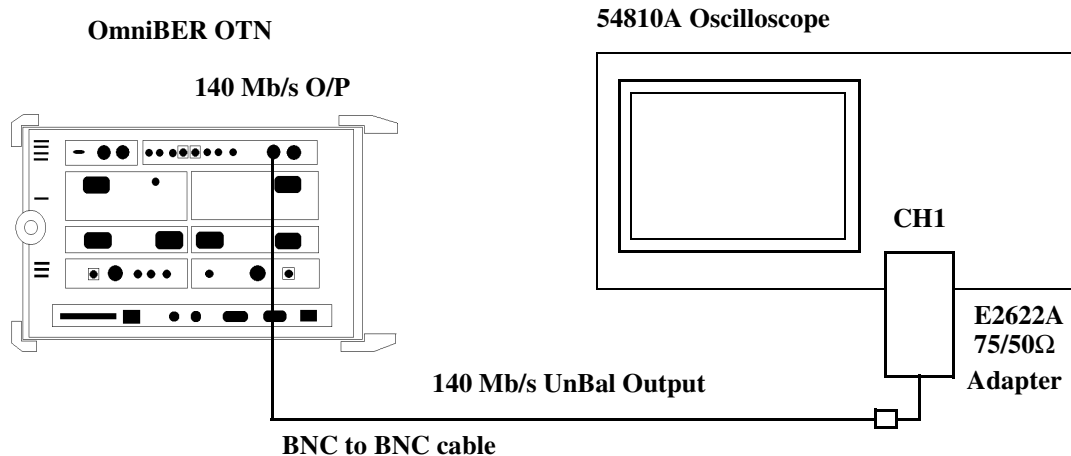
► **To test the 140 Mb/s output pulse mask**

- 1 Recall the OmniBER OTN's default setting as shown on "Recall Default Settings" on page 62.

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

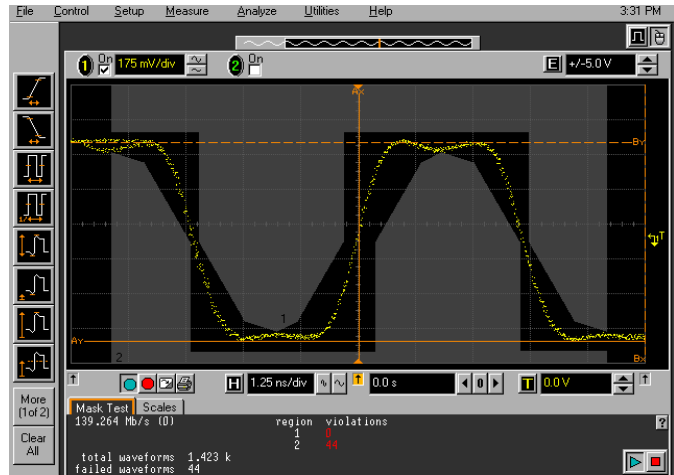


- 3 Connect the **140 Mb/s OUT** port to the Oscilloscope CHAN 1, using the E2622A Termination Adapter Probe.

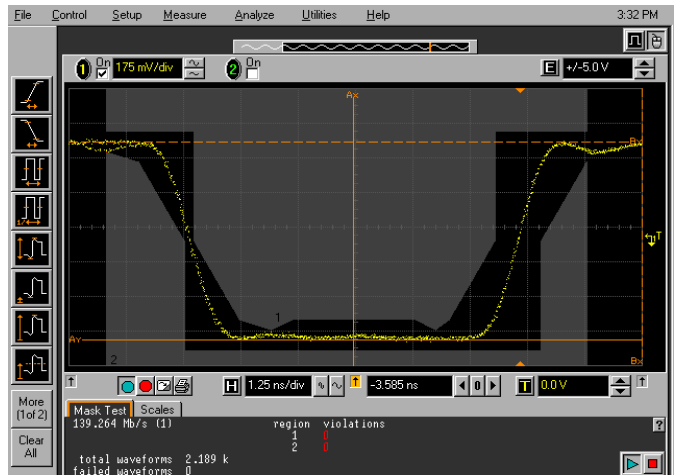


3 Performance Tests

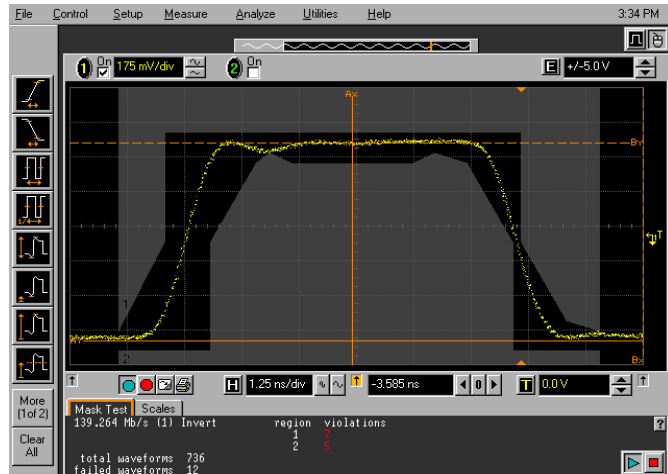
- 4 Load the **140Mb_ITU_0.msk**, **140Mb_ITU_1.msk** and **140Mb_ITU_1_INV.msk** test masks and check each of the pulses are within the mask (see examples).



140Mb/s All Zeros Mask Test



140Mb/s All Ones Mask Test

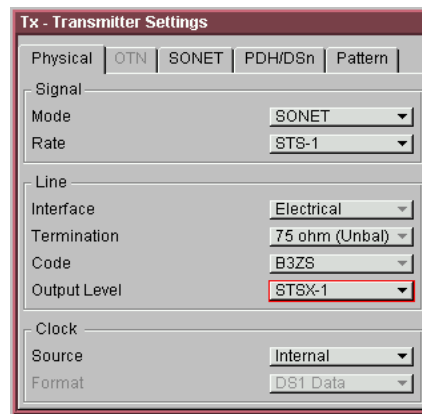


140Mb/s All Ones (inverted) Mask Test



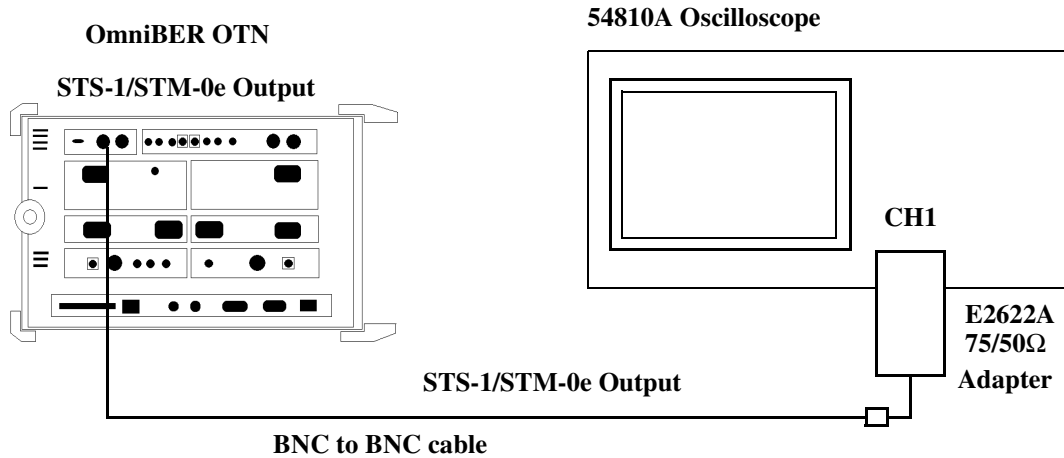
To test the 51.84 Mb/s (STS-1) output pulse mask

- 1 Recall the OmniBER OTN's default setting as shown on "[Recall Default Settings](#)" on page 62.
- 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 Performance Tests

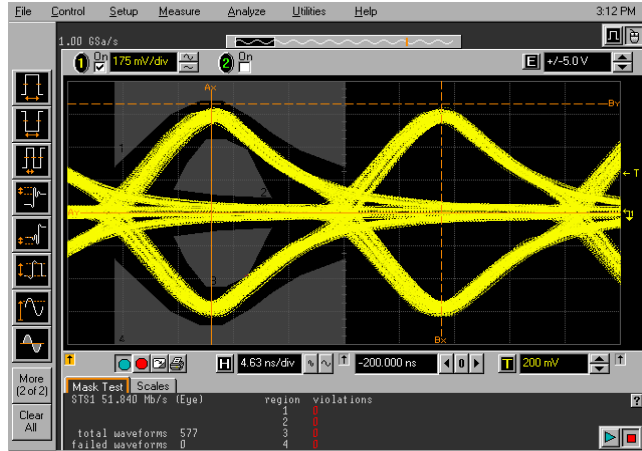
- 3 Connect the **52 Mb/s OUT** port to the Oscilloscope CHAN 1, using the E2622A Termination Adapter Probe.



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

NOTE

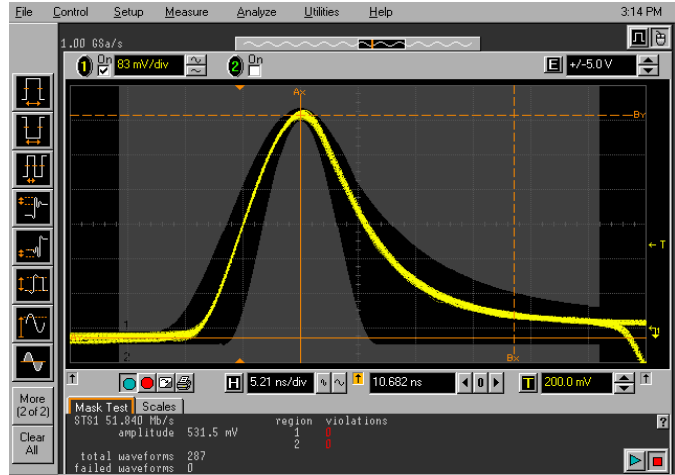
It may be necessary to use Manual settings to Align this mask. If necessary change the selection in the scope Mask Test Set-up to allow manual settings rather than File Set-up for Alignment.



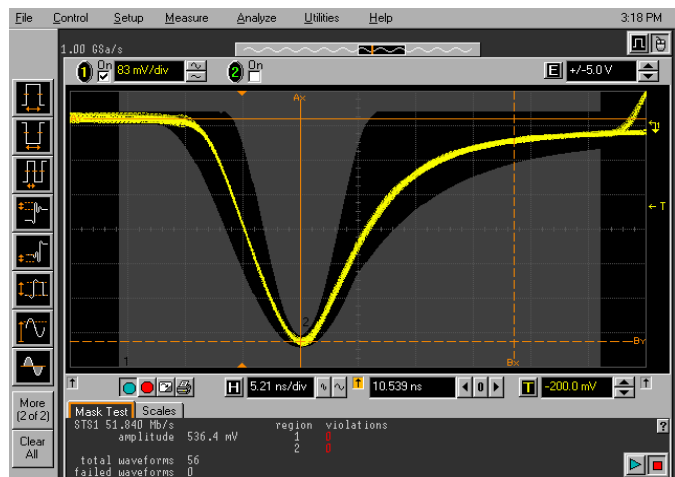
STSX-1 Mask Test

3 Performance Tests

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



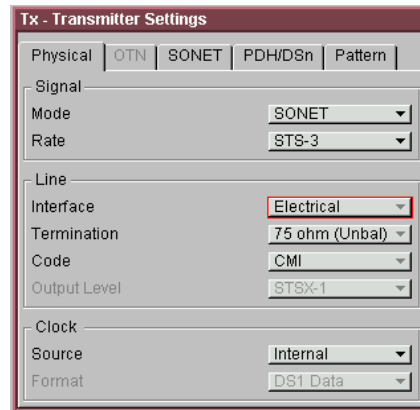
STXS-1 Positive Pulse Mask Test



STXS-1 Negative Pulse Mask Test

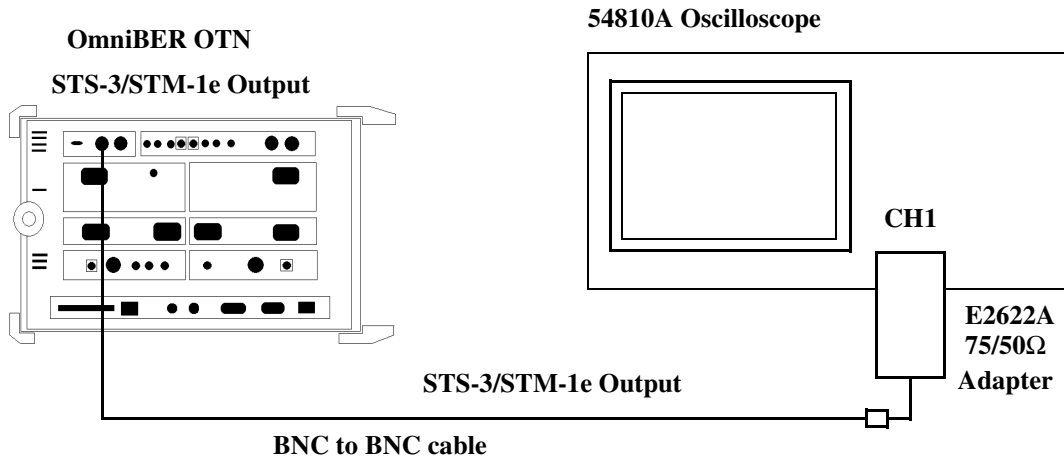
► **To test the 155 Mb/s output pulse mask**

- 1 Recall the OmniBER OTN's default setting as shown on "Recall Default Settings" on page 62.
- 2 Press <Menu>, select **Tx/Rx > Transmitter Settings** and set the **Signal Mode** to **SONET**. Now set the **Signal Rate** to **STS-3**.

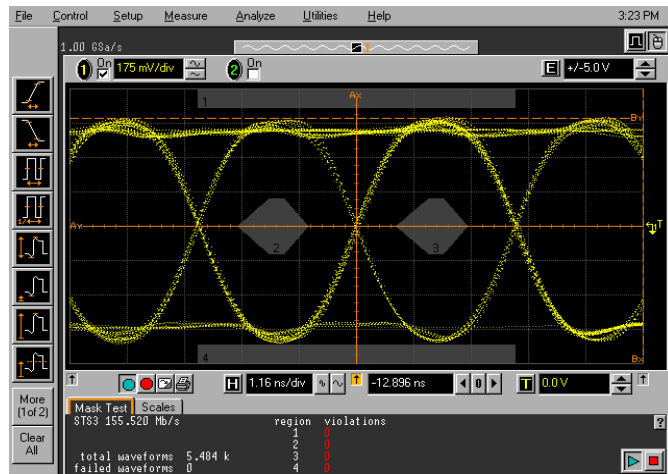


- 3 Connect the **155 Mb/s OUT** port to the Oscilloscope CHAN 1, using the E2622A Termination Adapter Probe.

3 Performance Tests



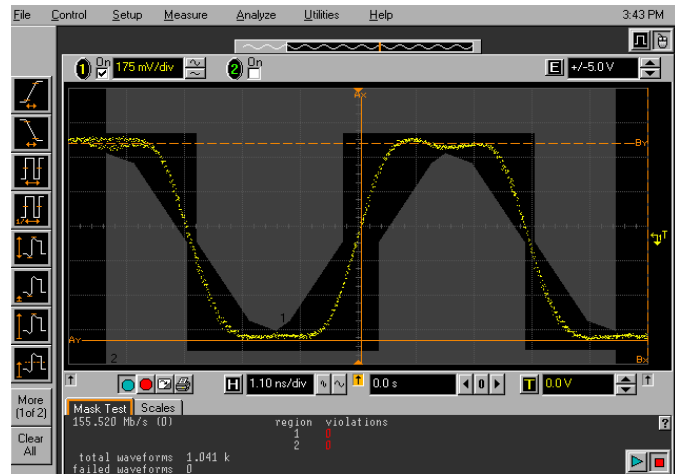
- 4 Load the STS3_ANSI.msk test mask and check the eye meets the mask (see example).



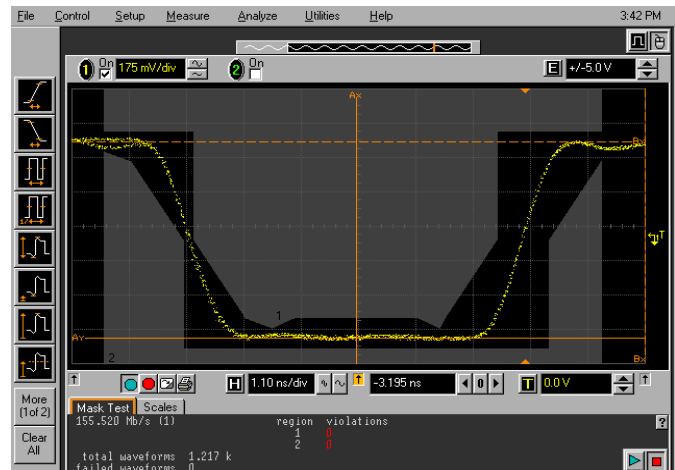
STS-3 Eye Mask Test

- 5 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.

- 6 Load the **155Mb_ITU_0.msk** test mask and check the 'zero' pulses are within the mask. See examples.
- 7 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).

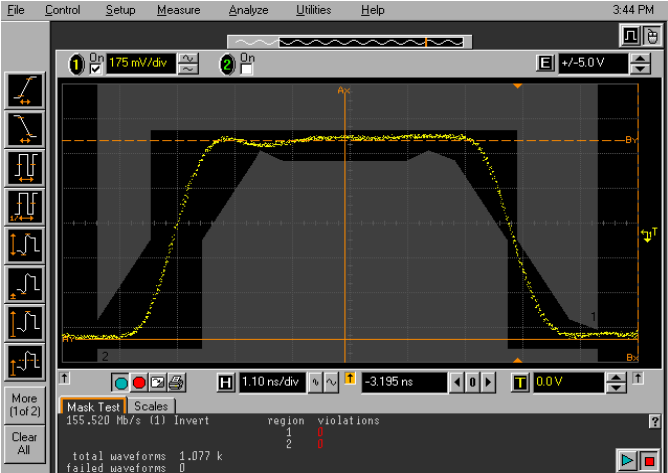


STM-1 All Zeros Mask Test



STM-1 All Ones Mask Test

3 Performance Tests



STM-1 All Ones (inverted) Mask Test

Performance Test Record

Model: Agilent J7230A 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 does not apply for your instrument.

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

3 Performance Tests

Page No.	Test Description	Min	Result Actual	Max
77	step 10/step 7 Signal Locked		Pass/Fail	
78	step 16 2 Mb/s Data Ext Unbal	2.047999999 MHz		2.048000001 MHz
78	step 17 Signal Locked		Pass/Fail	
78	step 21 2 Mb/s Data Ext Bal	2.047999999 MHz		2.048000001 MHz
78	step 22 Signal Locked		Pass/Fail	
80	step 26 No Alarm/Errors		Pass/Fail	
80	step 27 DS1 Ext	1543999 Hz		1544001 Hz
80	step 28 Signal Locked		Pass/Fail	
Optical Pulse Mask and Output Characteristics				
Option 104/106	1310nm Optical Port (52 Mb/s - 2.66 Gb/s)			
85	step 9 OC-1/STM-0 Mask		Pass/Fail	
85	step 11 OC-1/STM-0 (ER)	>8.2 dB		N/A
86	step 16 OC-3/STM-1 Mask		Pass/Fail	
86	step 18 OC-3/STM-1 (ER)	>8.2 dB		N/A
86	step 23 OC-12/STM-4 Mask		Pass/Fail	
86	step 25 OC-12/STM-4 (ER)	>8.2 dB		N/A
88	step 33 OC-48/STM-16 Mask		Pass/Fail	
89	step 35 OC-48/STM-16 (PWR)	-5 dBm		+0 dBm
89	step 36 OC-48/STM-16 (ER)	>8.2 dB	Pass/Fail	N/A
Option 111				
87	step 37/step 33 OTU-1 Mask		Pass/Fail	
87	step 37/step 35 OTU-1(PWR)	-2 dBm		+3 dBm

Page No.	Test Description	Min	Result Actual	Max
87	step 37/ step 36 OTU-1 (ER)	>8.2 dB	Pass/Fail	N/A
Option 105/106	1550nm Optical Port (52 Mb/s - 2.66 Gb/s)			
85	step 9 OC-1/STM-0 Mask		Pass/Fail	
85	step 11 OC-1/STM-0 (ER)	>8.2 dB		N/A
86	step 16 OC-3/STM-1 Mask		Pass/Fail	
86	step 18 OC-3/STM-1 (ER)	>8.2 dB		N/A
86	step 23 OC-12/STM-4 Mask		Pass/Fail	
86	step 25 OC-12/STM-4 (ER)	>8.2 dB		N/A
88	step 33 OC-48/STM-16 Mask		Pass/Fail	
89	step 35 OC-48/STM-16 (PWR)	-2 dBm		+3 dBm
89	step 36 OC-48/STM-16 (ER)	>8.2 dB	Pass/Fail	N/A
Option 111				
87	step 37/ step 33 OTU-1 Mask		Pass/Fail	
87	step 37/ step 35 OTU-1(PWR)	-5 dBm		+0 dBm
87	step 37/ step 36 OTU-1 (ER)	>8.2 dB	Pass/Fail	N/A
	1550nm Optical Port (9.95 Gb/s and 10.7 Gb/s)			
All options				
92	step 8 OC-192/STM-64 Mask		Pass/Fail	
92	step 10 OC-192/STM-64 (PWR)	-1 dBm -5 dBm		+1 dBm (version 1) -1 dBm (version 2)
92	step 11 OC-192/STM-64 (ER)	>8.2 dB	Pass/Fail	
Option 112				

3 Performance Tests

Page No.	Test Description	Min	Result Actual	Max
94	step 17	OTU-2 Output Mask	Pass/Fail	
94	step 19	OTU-2 Output (PWR)	-1 dBm -5 dBm	+1 dBm (version 1) -1 dBm (version 2)
94	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				
100	step 5	Laser LED ON	Pass/Fail	
100	step 6	Note Attenuator Setting	N/A	N/A
101	step 9	'No Trouble' Min Sens	Pass/Fail	
101	step 10	Additional Attenuation	Typ > 1 dB	N/A
101	step 11	-30 dBm PWR meas	-31 dBm	-29 dBm
101	step 11	OC-1/STM-0 Frequency	51.83999 MHz	51.84001 MHz
103	step 12	-10 dBm PWR meas	-11 dBm	-9 dBm
103	step 13	'No Trouble' Max Sens	Pass/Fail	
103	step 15	Power Meter check	-10.5	-9.5
100	step 5	Laser LED ON	Pass/Fail	
100	step 6	Note Attenuator Setting	N/A	N/A
101	step 9	'No Trouble' Min Sens	Pass/Fail	
101	step 10	Additional Attenuation	Typ > 1 dB	N/A
101	step 11	-30 dBm PWR meas	-31 dBm	-29 dBm
101	step 11	OC-3 /STM-1 Frequency	155.51999 MHz	155.52001 MHz
103	step 12	-10 dBm PWR meas	-11 dBm	-9 dBm

Page No.	Test Description	Min	Result Actual	Max
103	step 13	'No Trouble' Max Sens	Pass/Fail	
103	step 15	Power Meter check		-9.5
Optical Receive Port (622 Mb/s)				
103	step 17	Laser LED ON	Pass/Fail	
103	step 18	Note Attenuator Setting	N/A	N/A
104	step 21	'No Trouble' Min Sens	Pass/Fail	
104	step 22	Additional Attenuation	Typ > 1 dB	N/A
104	step 23	-28 dBm PWR meas	-29 dBm	-27 dBm
104	step 23	OC-12/STM-4 Frequency	622.07999 MHz	622.08001 MHz
104	step 24	-9 dBm PWR meas	-10 dBm	-8 dBm
104	step 25	'No Trouble' Max Sens	Pass/Fail	
105	step 27	Power Meter check		-8.5
Optical Receive Port (2.5 Gb/s)				
106	step 4	Laser LED ON	Pass/Fail	
106	step 5	Note Attenuator Setting	N/A	N/A
106	step 8	'No Trouble' Min Sens	Pass/Fail	
107	step 9	Additional Attenuation	Typ > 1 dB	N/A
107	step 10	-28 dBm PWR meas	-30 dBm	-26 dBm
107	step 10	OC-48/STM-16 Frequency	2488.3199 MHz	2488.3201 MHz
107	step 11	-9 dBm PWR meas	-11 dBm	-7 dBm
107	step 12	'No Trouble' Max Sens	Pass/Fail	
107	step 14	Power Meter check		-8.5
Opt 111	Optical Receive Port (2.66 Gb/s)			

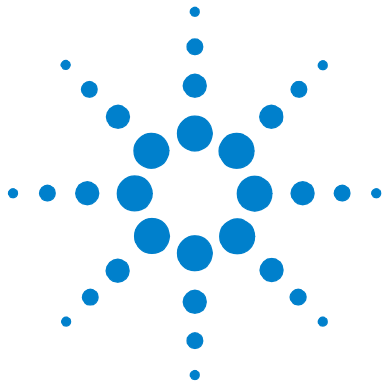
3 Performance Tests

Page No.	Test Description	Min	Result Actual	Max
108	step 16 Note Attenuator Setting	N/A		N/A
108	step 19 'No Trouble' Min Sens		Pass/Fail	
108	step 20 Additional Attenuation	Typ > 1 dB		N/A
108	step 21 -26 dBm PWR meas	-28 dBm		-24 dBm
108	step 21 OTU-1 Frequency	2666.0570 MHz		2666.0572 MHz
109	step 22 -9 dBm PWR meas	-11 dBm		-7 dBm
109	step 23 'No Trouble' Max Sens		Pass/Fail	
109	step 25 Power Meter check	-9.5		-8.5
Optical Receive Port (9.95 and 10.7 Gb/s)				
110	step 4 Laser LED ON		Pass/Fail	
111	step 5 Note Attenuator Setting	N/A		N/A
111	step 8 'No Trouble' Min Sens		Pass/Fail	
111	step 9 Additional Attenuation	Typ > 1 dB		N/A
111	step 10 -14dBm PWR meas	-15.5 dBm		-12.5 dBm
111	step 10 OC-192/STM-64 Frequency	9953.2799 MHz		9953.2801 MHz
Option 112				
112	step 11 Laser LED ON		Pass/Fail	
112	step 12 Note Attenuator Setting	N/A		N/A
112	step 15 'No Trouble' Min Sens		Pass/Fail	
112	step 16 Additional Attenuation	Typ > 1 dB		N/A
112	step 17 -14dBm PWR meas	-15.5 dBm		-12.5 dBm
112	step 17 OTN Output Frequency	1070.9224 MHz		1070.9226 MHz

Page No.	Test Description	Min	Result Actual	Max
All options				
113	Check Receiver Sensitivity margin v.s. Transmitter Extinction Ratio		Pass/Fail	
Electrical Pulse Mask and Output Characteristics (opt 012 Only)				
DS1 Output Mask Tests				
page 116	step 4	DS1 ANSI Mask	Pass/Fail	
page 117	step 5	DSX-1 Pulse Amplitudes	Pass/Fail	
page 117	step 6	DSX1-LO Output Level	Pass/Fail	
2 Mb/s Balanced Output Mask Tests				
page 119	step 4	2 Mb/s ITU 120 Mask	Pass/Fail	
page 122	step 4	2 Mb/s ITU 75 Mask	Pass/Fail	
8 Mb/s Output Mask Tests				
page 124	step 4	8 Mb/s ITU Mask	Pass/Fail	
34 Mb/s Output Mask Tests				
page 127	step 4	34 Mb/s ITU Mask	Pass/Fail	
DS3 Output Mask Tests				
page 129	step 4	DS3 ANSI Mask	Pass/Fail	
140 Mb/s Output Mask Tests				
page 132	step 4	140 Mb/s ITU Masks	Pass/Fail	
STS-1 (51 Mb/s) Output Mask Tests				
page 134	step 4	STS-1 Eye Mask	Pass/Fail	
page 136	step 5	STS-1 ANSI Mask	Pass/Fail	
STS-3 Output Mask Tests				
page 138	step 4	STS-3 ANSI Mask	Pass/Fail	

3 Performance Tests

page 139	step 6	155 Mb/s ITU_0 Mask	Pass/Fail
page 139	step 7	155 Mb/s ITU_1s Mask	Pass/Fail



4 Self Test Overview

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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.

The screenshot shows the 'Selftest' interface with the following details:

- Cabling Config:** 2.5G Optical interface port: Tx(1310nm) to Rx + attenuation; 10G Optical interface port: Tx(1550nm) to Rx(10Gbs) + attenuation.
- Run:** Radio buttons for 'All tests' and 'Selected test'; 'Selected test' dropdown menu is set to 'Confidence Tests'.
- Status:** 'Test run is currently stopped' with a 'Start' button.
- Estimated test time:** 0 hours 2 minutes; 0 hours 1 minutes remaining.
- Current test:** Confidence Tests
- Current subtest:** Conf DS1
- Failure count:** 0 failure(s) found
- Result:** A large yellow box displays 'PASSED' followed by a timestamp '25-Aug-2008 14:18:54'.
- Footer:** 'Press Select to start/stop selected test' and 'Status: Laser-OFF'.

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

Test	Title	Description
1	Platform Test	This test is for factory use only. It performs basic test of the CPU memory and IDE interface.
2	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.
3	Optical Power Test	This test checks both the data paths and the optical power measurement circuitry.
4	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.
7	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.
9	Long Gating Test	This test is for factory use only.
11	Loop Back Test	This test is for factory use only.
12	Confidence Test 10 Gb/s Optics	This test performs a confidence test on the 10 Gb/s optical paths only.
13	Confidence Test 2.5 Gb/s - 52 Mb/s Optics	This test performs a confidence test on the 2.5 Gb/s - 52 Mb/s optical paths only.

4 Self Test Overview

Test	Title	Description
14	Confidence Test Electrical Unbalanced Ports (52 Mb/s down to DS3)	This test performs a confidence test on the unbalanced electrical paths only.
15	Confidence Test E1 Balanced Ports	This test performs a confidence test on the E1 balanced port only.
16	Confidence Test DS1 Balanced Ports	This test performs a confidence test on the DS1 balanced port only.

Loopback Connections Required for Self Test

The Self Test loopbacks required for each test are listed below. Those required are dependent on the Options fitted and Test selected. See diagram on [page 154](#) indicating loopback connections for a J7230A with option 106. The table indicates the minimum test loopback requirements.

Optical Loopback Connections (Dependent on instrument Wavelength options fitted)

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

- Connect 9.95/10.71 Gb/s Optical Out <> 15 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
- Connect 52 Mb/s-2.5 Gb/s Optical Out <> 15 dB Attenuator <> 52 Mb/s-622 Mb/s Optical In

Electrical Connections SONET/SDH 52 Mb/s to 155 Mb/s (Required on all instruments)

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)

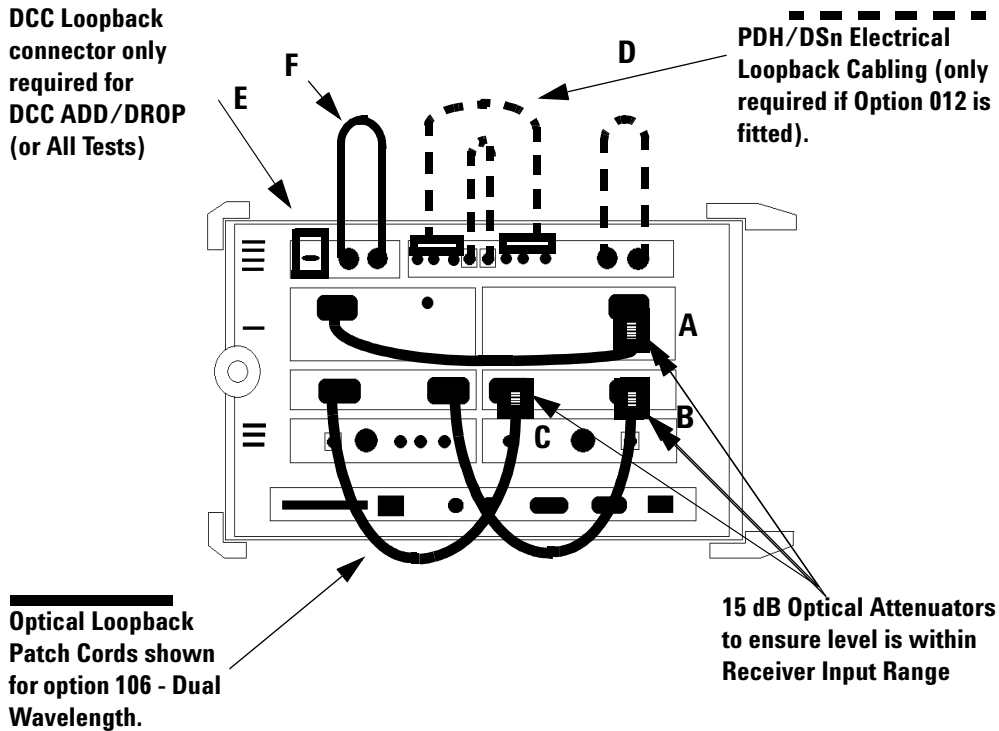
Balanced Electrical Connections 2M/DS1 (Instruments with Option 012 only)

Use 3-pin Siemens cable P/N 15512A and Bantam cable P/N 15670A

- Connect 2M Out (3-pin Siemens) <> 2M In
- Connect DS1 Out <> DS1 In

DCC Loopback Connector (Only required if DCC ADD/DROP TEST or All tests are selected)

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



Loopback connections for option 106

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.

Minimum test loopback requirements

Self Test	Optical Loopback (15 dB attenuation must be used)	Electrical Loopback	DCC Loopback plug
	Loopbacks used are dependent on Options fitted	Only required if Option 012 is installed.	
• All tests	A, B, C, F	D	E
• Confidence Test	A, B, C, F	D	not required
Confidence Tests (10Gb/s Optics)	A		
Confidence Tests (2.5Gb/s - 52 Mb/s Optics)	B, C		
Confidence Tests Unbalanced Electrical Ports (52 Mb/s down to DS3)		D	
Confidence Tests(E1 Balanced Ports)		E	
Confidence Tests (DS1 Balanced Ports)		F	
• Optical Power Test	A, B, C	not required	not required
• DCC Add/Drop Test	A	not required	E
• Frequency Test	A, B, C	D	not required

NOTE

If single wavelength optics are fitted to the 2.5 Gb/s - 52 Mb/s Optical Out port then the Self Test should be performed twice to verify all the Optical In ports. Perform the test with the 2.5 Gb/s-52 Mb/s Optical Out port connected to the 2.5 Gb/s Optical In port and repeat with the 2.5 Gb/s-52 Mb/s Optical Out port connected to the 662-52 Mb/s Optical In port. Select the cable configuration from the test menu as appropriate.

How to Run a Self Test



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. 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.

Selftest

Cabling Config
 2.5G Optical interface port Tx(1310nm) to Rx + attenuation
 10G Optical interface port Tx(1550nm) to Rx(10Gb/s) + attenuation

Run All tests
 Selected test: Confidence Tests

Status: Test run is currently stopped

Estimated test time hours minutes hours minutes remaining

Current test Confidence Tests
 Current subtest Conf DS1 failure(s) found

Date	Time	Test	Subtest	Failure
25-Aug-2008	14:28:45	Confidence Tests	Conf2.5Gb/s 1310nm	LOS Alarm Detected
25-Aug-2008	14:29:06	Confidence Tests	Conf622Mb/s 1310nm	LOS Alarm Detected
25-Aug-2008	14:29:26	Confidence Tests	Conf155Mb/s 1310nm	LOS Alarm Detected
25-Aug-2008	14:29:47	Confidence Tests	Conf52Mb/s 1310nm	LOS Alarm Detected

[Press Select to start/stop selected test](#)

Status:

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.

Test 1 - Platform Test

This test is for factory use only. It performs basic test of the CPU memory and IDE interface.

Test 2 - Confidence Test

Sub Test Number	Sub Test Description
1	Conf 10 Gb/s 1550 nm
2	Conf 2.5 Gb/s 1310 nm
3	Conf 2.5 Gb/s 1550 nm
4	Conf 622 Mb/s 1310 nm
5	Conf 622 Mb/s 1550 nm
6	Conf 155 Mb/s 1310 nm
7	Conf 155 Mb/s 1550 nm
8	Conf 52 Mb/s 1310 nm
9	Conf 52 Mb/s 1550 nm
10	Conf 155 Mb/s
11	Conf 52 Mb/s
12 (opt 012 only)	Conf E4 Unbal
13 (opt 012 only)	Conf E3 Unbal
14 (opt 012 only)	Conf E2 Unbal
15 (opt 012 only)	Conf E1 Unbal
16 (opt 012 only)	Conf E1 Bal
17 (opt 012 only)	Conf DS3 Unbal
18 (opt 012 only)	Conf DS1Bal
19 (opt 110 only)	10.7 Gb/s Test Signal
20 (opt 110 only)	10.7 Gb/s SDH Payload

Test 3 - 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

Test 4 - DCC Add/Drop Test

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

Test 7 - Frequency Measurement

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

Test 12 - Confidence Test 10 Gb/s Optical

Sub Test Number	Sub Test Description
1	Conf 10 Gb/s 1310/1550 nm

Test 13 - Confidence Test 2.5 Gb/s - 52 Mb/s Optical

Sub Test Number	Sub Test Description
2	Conf 2.5 Gb/s 1310 nm
3	Conf 2.5 Gb/s 1550 nm
4	Conf 622 Mb/s 1310 nm
5	Conf 622 Mb/s 1550 nm
6	Conf 155 Mb/s 1310 nm
7	Conf 155 Mb/s 1550 nm
8	Conf 52 Mb/s 1310 nm
9	Conf 52 Mb/s 1550 nm

Test 14 - Confidence Test Unbalanced Electrical

Sub Test Number	Sub Test Description
10	Conf 155 Mb/s
11	Conf 52 Mb/s
12	Conf E4 Unbal
13	Conf E3 Unbal
14	Conf E2 Unbal
15	Conf E1 Unbal
17	Conf DS3 Unbal

Test 15 - Confidence Test E1 Balanced

Sub Test Number	Sub Test Description
16	Conf E1 Bal

Test 16 - Confidence Test DS1 Balanced

Sub Test Number	Sub Test Description
18	Conf DS1 Bal

What to Do if the Self Test Fails

- ▶ **To check self test failures**
 - 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 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



5 ETSI/ANSI Terminology

The terminology used on the instrument display can be ETSI (SDH) or ANSI (SONET). Refer to the table given in this section for an explanation of equivalent SDH/SONET terms.



ETSI/ANSI Conversion and Equivalent Terms

ETSI: European Telecommunications Standards Institute.

ANSI: American National Standards Institute.

ETSI (SDH) Term	ANSI (SONET) Term
AU-3	STS-1 SPE + H1, H2, H3
AU-4	STS-3c SPE + H1, H2, H3
BIP (Bit Interleaved parity)	CV (Code Violation)
High Order Path (HP / HO)	STS Path
I-n Intra Office, (n=STM-n level)	Intermediate Reach (IR)
L-n.1 or L-n.2 long haul	LR long reach
Low Order Path (LP / LO)	VT Path
LP-REI	REI-V
M.S.P	A.P.S
Multiplexer Section (MS)	Line
Multiplexer Section Protection	Automatic Protection Switching
MS-AIS	Line AIS / AIS-L
MS-BIP	Line CV / CV-L
MS-DCC	Line DCC / DCC-L
MS-REI	Line FEBE / REI-L
MS-RDI	Line FERF / RDI-L
Multiplexer Section Overhead	Line Overhead
Network Node Interface	Line Interface
OOF	SEF (severely errored frame defect)
Path AIS / AU-AIS	AIS-P
Path REI / HP REI	REI-P
Path FERF / HP RDI	RDI-P

ETSI (SDH) Term	ANSI (SONET) Term
Path IEC / AU-IEC	IEC-P
Path Overhead	Path Overhead
Regenerator	Repeater
Regenerator Section (RS)	Section
Regenerator Section Overhead	Section Overhead
Remote Alarm Indicator	RAI
RS-DCC	Section DCC (DCC-S)
Section Overhead (SOH)	Transport Overhead (TOH)
S-n.1 or S-n.2 short haul	Short Reach (SR)
SOH	TOH
STM-m	OC-n / STS-n (where $m = n \div 3$ for $m \geq 1$)
STM-0	STS-1
STM-1	OC3c / STS-3c
STM-4	OC-12 / STS-12
STM-16	OC-48 / STS-48
STM-64	OC-192
Tributary Unit (TU)	Virtual Tributary (VT)
TU	VT
TU-11	VT 1.5
TU-12	VT 2
TU-2	VT 6
TU-3	NONE
TU BIP	VT BIP (CV-V)
TU RDI / LP-RDI	RDI-V
TUG	VT Group
TUG2	VT Group (12 columns)

5 ETSI/ANSI Conversion and Equivalent Terms

ETSI (SDH) Term	ANSI (SONET) Term
TUG3	VT Group (86 columns)
TU multiframe	VT superframe
TU PATH AIS	VT AIS (AIS-V)
VC	SPE
VC4	STS3C SPE
Virtual Container (VC)	Synchronous Payload Envelope (SPE)

NOTE: VC is an ETSI abbreviation for Virtual Container and an ETSI / ANSI abbreviation for (ATM) Virtual Channel. The context of VC must therefore be taken into account when converting between standards.

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Printed in U.K. 01/03
J7230-90035



Agilent Technologies