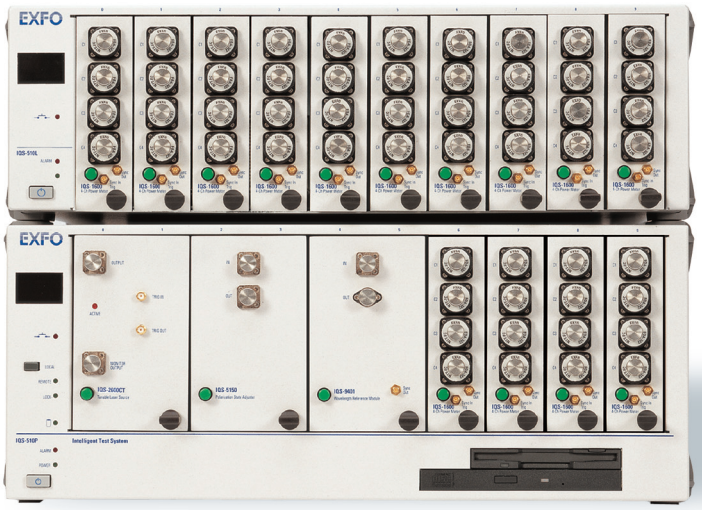
DWDM PASSIVE COMPONENT TEST SYSTEM

IQS-12004B

R&D AND MANUFACTURING–OPTICAL



- IL, PDL and ORL measurements as a function of wavelength
- C+L-band configuration
- Comprehensive integrated software
- Extensive data interpretation

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Telecom Test and Measurement

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EXPERTISE REACHING OUT

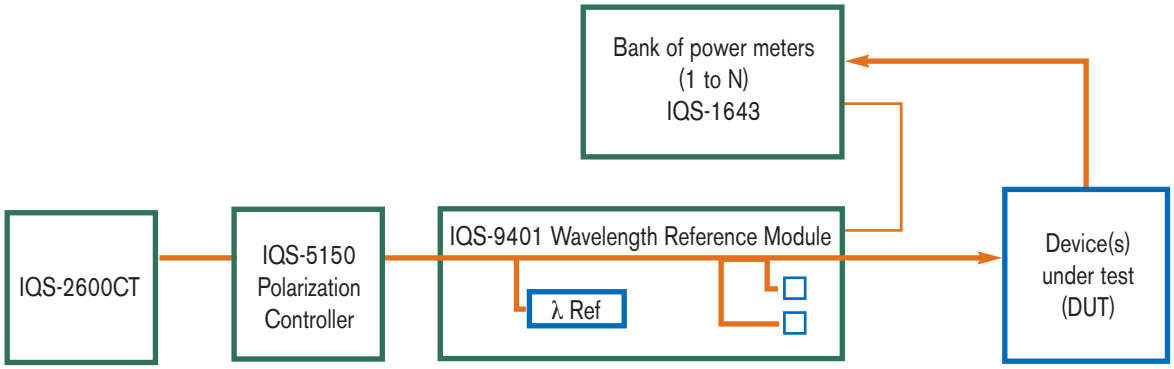
Next-Generation DWDM Passive Component Test System

The IQS-12004B provides fast, accurate, high-resolution characterization of dense WDM passive components. This system combines a low-noise sweeping tunable laser source, multichannel power meters, a wavelength reference module and an optional polarization-state adjuster.

This powerful solution offers the capability to test both in the C and L bands with reduced testing time and hands-free PDL measurement. The IQS-12004B automatically characterizes DWDM passive components for IL, flatness, central wavelength, bandwidth, crosstalk, PDL, ORL and more.

With EXFO's IQS-12004B, passive component manufacturers get the scalability they need, as a fully integrated 16-channel configuration fits in one 4U unit delivering insertion loss, ORL and PDL measurements. The system operates in Win 2000 and efficiently meets all DWDM passive component T&M needs. It is equipped with a Pentium III processor and housed up to 10 single-slot modules, which enables optimal performance in industrial applications. What's more, the cost-effective IQS-12004B can support more than 80 channels.

IQS-12004B System Overview



This test system sweeps a very low-noise tunable laser source, while measuring power on multiple channels; this provides quick testing time that is practically independent of the number of device ports. The wavelength reference module ensures accuracy by providing a fast and continuous wavelength and power reference throughout the sweep. PDL measurements, calculated using the Mueller Matrix method, are optional and provide PDL vs. wavelength across the complete range. The attenuation and PDL sweeps are completed without any fiber handling.

The test system also provides ORL vs. wavelength measurement. This feature is standard, and the measurement is performed by a dedicated detector in the IQS-9401 Wavelength Reference Module.

High-resolution testing of single and multichannel DWDM passive components generates vast quantities of data. The IQS-12004B system has been designed to take advantage of internal high-speed data transfer, resulting in reduced measurement and data transfer time.

TEST EQUIPMENT

CONTROLLER

The IQS-12004B is available with the IQS-510P Intelligent System. This core unit houses a Pentium III processor and is optimized with 10 module slots.

The IQS-510P can control up to 9 IQS-510E expansion units.

IQS-510E EXPANSION UNIT

The expansion unit is available with 10 slots. Up to 9 units can be connected to the IQS-510P Control unit.

The IQS-500 platform is backward-compatible with the modules of the IQ-200 Optical Test System.

TUNABLE LASER SOURCE (TLS)

The IQS-2600CT covers the 1511 nm to 1611 nm (C+L band) range.

IQS-5150 POLARIZATION STATE ADJUSTER (PSA)–(OPTIONAL)

- A two-slot module
- Generates four orthogonal states of polarization
- Designed around bulk-optic components
- Uses the Mueller Matrix calculation method for PDL measurement
- No fiber handling required

IQS-9401 WAVELENGTH REFERENCE MODULE (WRM)

- A two-slot module
- Gives fast and accurate absolute wavelength reference
- Provides dynamic power reference for attenuation and polarization-dependent loss (PDL) measurements
- Performs the optical return loss (ORL) measurements
- Provides synchronization signal

IQS-1643T* POWER METER (FOUR CHANNELS)

- Four detectors in a one-slot module
- Optimized for low polarization dependence
- Optimized for low spectral interference
- Optimized for fast autoranging
- Direct memory access for fast data transfer
- High sensitivity for high-loss measurements

* Protected by US patent 6,621,067.

Comprehensive, Easy-to-Use Software

CONFIGURE

Supervisors can configure a database of frequently tested components that contains acceptance criteria for evaluating whether or not a component meets the desired requirements. This is a simple two-step procedure that configures not only the Pass/Fail limits, but, also, the IQS-12004B scan settings and analysis parameters.

Step One: Create a database containing frequently tested components.

Step Two: Once the ports are defined, the DUT configuration screen prompts you to enter a unique part number along with

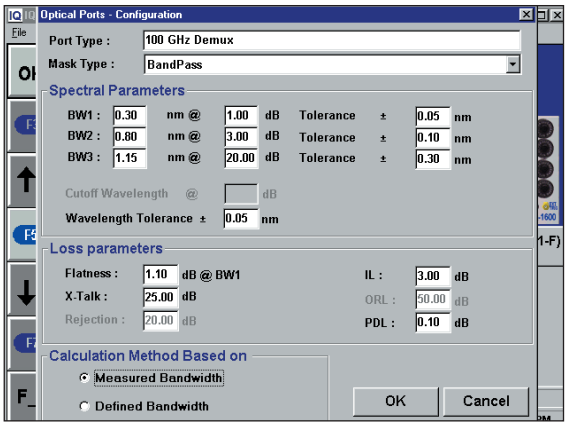
- the number of ports
- the type of each port
- the wavelength of each port
- the analysis range and scan resolution
- data analysis parameters

The window for optical port definition configures exacting Pass/Fail limits for all parameters. This includes IL, crosstalk, flatness, central wavelength, bandwidth, PDL and ORL. There is no practical limit to the number of ports that can be defined.

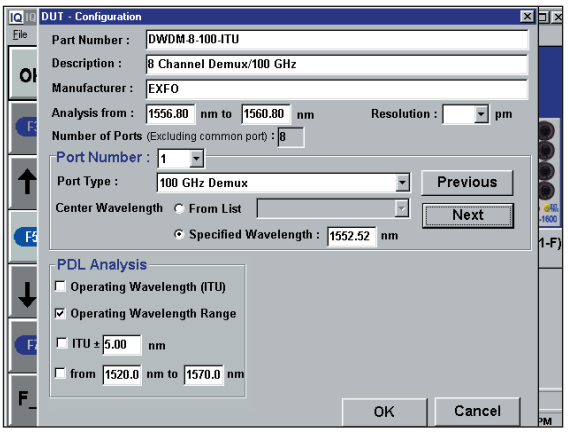
SELECT

During normal functioning, the system operator simply selects a component (unique part number) and starts the test. At this stage, all the test limits and test parameters will automatically be selected. This mode of operation is ideal for high-volume production testing.

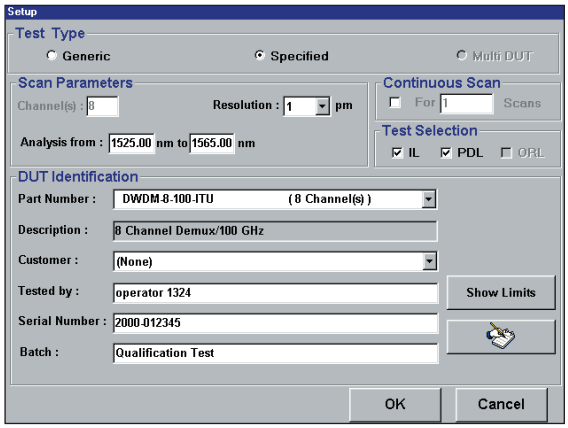
In addition, the system can test generic devices or components with unknown or undetermined characteristics. The system is simply configured by the operator (wavelength range, resolution and number of channels) and is ready to start testing. This mode of operation is perfect for R&D, qualification, receiving inspection and early production testing.



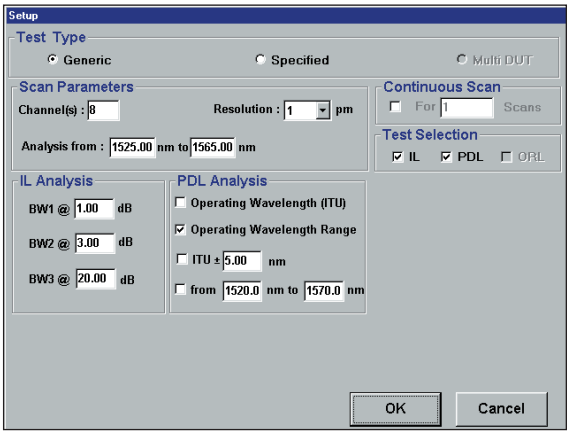
DUT port configuration



DUT configuration



Testing a specified component



Testing a generic component

Comprehensive, Easy-to-Use Software

TEST

Measure All Channels Simultaneously

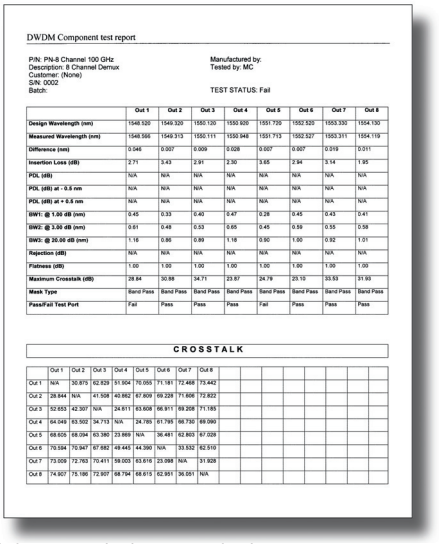
The IQS-12004B performs measurements at top speed and analyzes data rapidly, enabling the system operator to continue testing more devices. Tabulated test results clearly indicate if a device has passed or failed the test. In addition, they provide a detailed summary of all interpreted data, including central wavelength, insertion loss, flatness, PDL, ORL and a comprehensive crosstalk matrix.

Test Results Are Easy to Read and Interpret

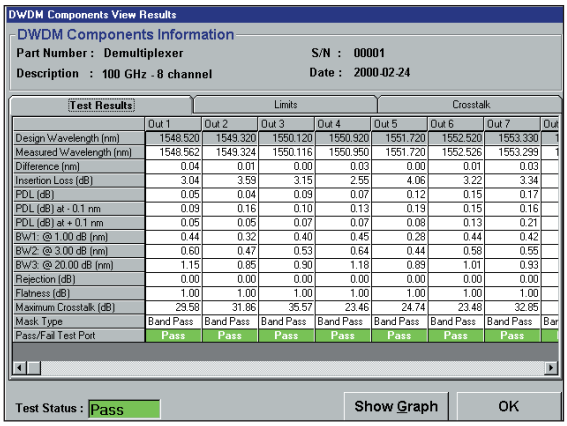
Graphical test results and analysis tools are also available for more detailed evaluation. Includes attenuation, PDL and ORL data as well as user-defined scales and markers. The IQS-12004B DWDM Passive Component Test System delivers everything expected of a high-performance test instrument.

MANAGE DATA

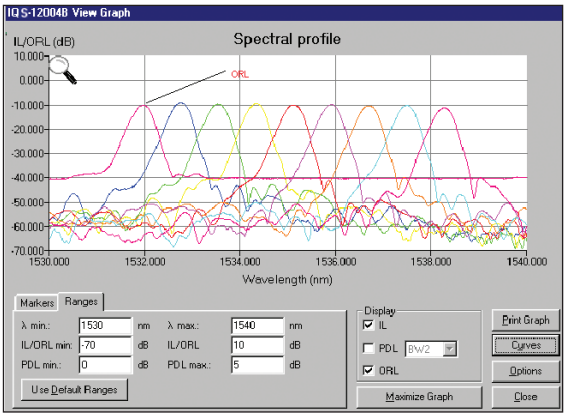
The IQS-12004B Passive Component Test System includes extensive data management features, such as network connection and compatibility, as well as a database browser permitting off-line or post-measurement analysis. Comprehensive data management enables all parameters and results to be saved to an Access™-compatible .MDB database. The software also offers file-transfer utilities such as, for example, TXT export.



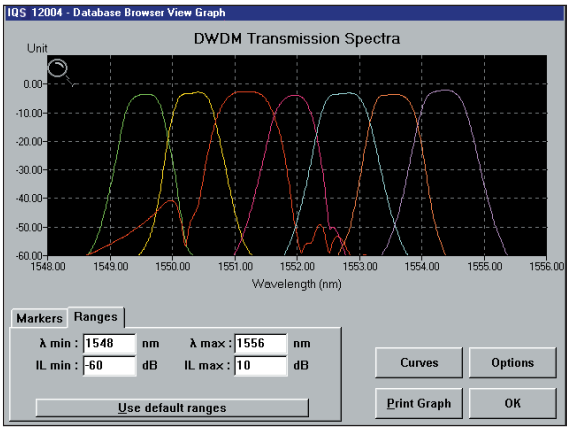
Select a standard or customized report



Tabulated test results



Graphical test results



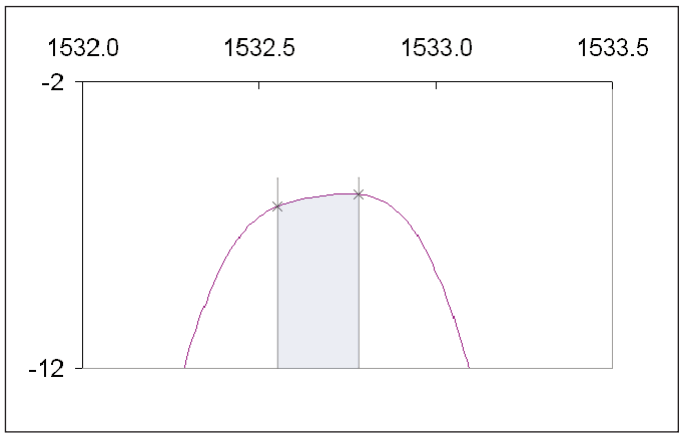
Use the database browser for reviewing and analyzing archived data.

Complete Device Characterization at the Touch of a Button

A COMPLETE DATA ANALYSIS PACKAGE

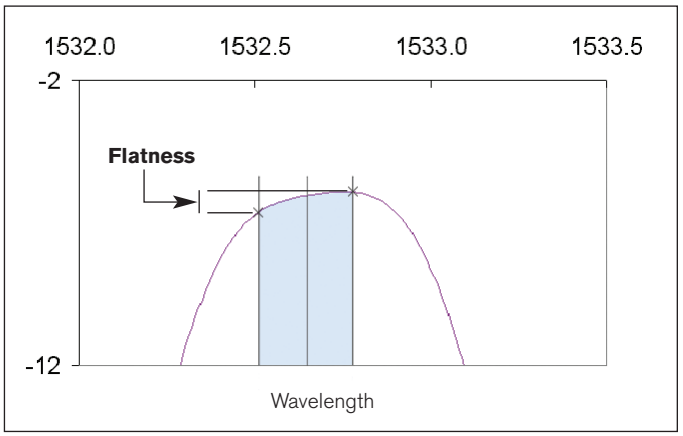
Insertion Loss

Calculates the IL value as the highest attenuation value within the boundaries of a channel, i.e., ITU ± DI (where DI is a user-defined parameter or, alternatively, a measured value).



Flatness

Calculates passband flatness as the difference between the maximum and minimum attenuation over the defined (or optionally measured) passband of the DUT.



New Features

- PDW (PDCW and PDBW)
- Minimum and maximum loss
- IL at 4 SOP and other new function

Polarization-Dependent Wavelength

The IQS-12004B system can perform polarization dependent wavelength (PDW) analysis. The PDW analysis is made using proprietary algorithms* and is based on calculations using the Mueller Matrix coefficients. Using data from the 4 scans performed for the polarization dependent loss measurement, the IQS-12004B analysis software internally calculates the transmission response for many states of polarization and generates the insertion loss curves for the extreme values.

This analysis provides a reliable detailed polarization characterization that is fast, hands free, and is based on only 4 scans.

The results are provided by both the IQS-12004B application and DLL/GPIB functions, and include the Polarization Dependent Center Wavelength (PDCW), the Polarization Dependent Bandwidth (PDBW), as well as the transmission data for the minimum and maximum center wavelengths. These min and max center wavelength data series, correspond to TE/TM transmission data.

The data shown on Fig.1, which is part of the internal PDW calculations of the IQS-12004B, shows the polarization dependence of the center wavelength for an AWG channel. The data on Fig.2 shows the transmission data for the corresponding minimum and maximum center wavelengths; the TE/TM response of the AWG.

Fig.1 Center Wavelength variation as a functon of input SOP

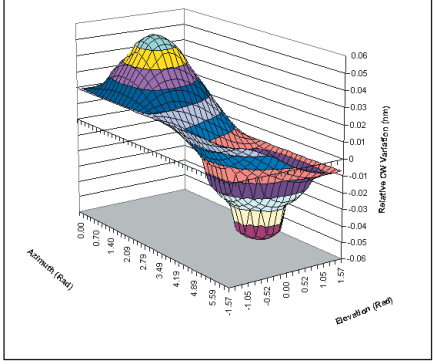
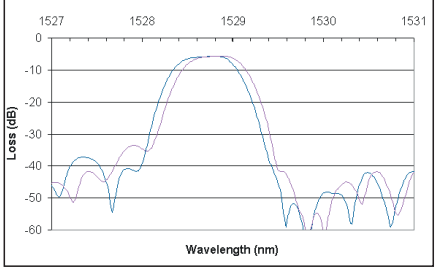


Fig.2 Loss data for minimum and maximum Center Wavelengths

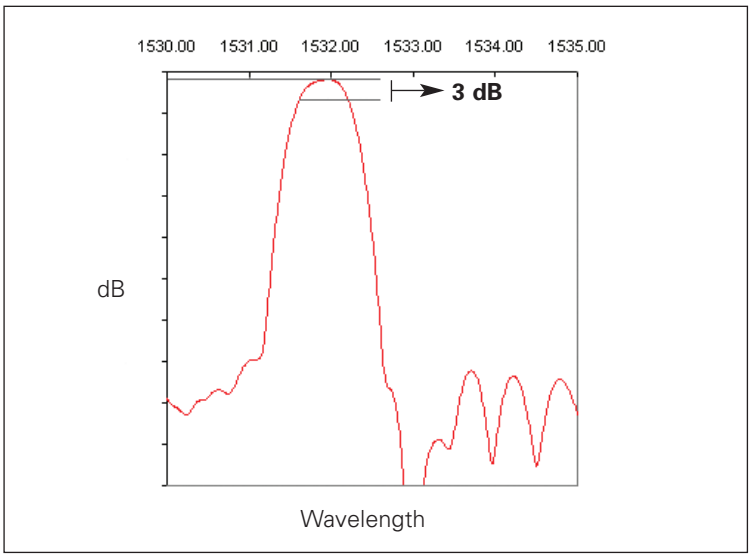


* Protected by US patent 6,7621,829.

Complete Device Characterization at the Touch of a Button

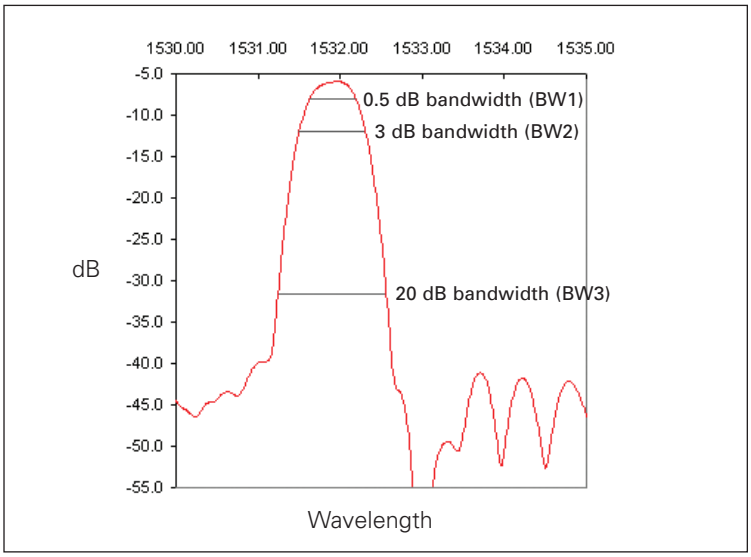
Central Wavelength

Measures the central wavelength as the midpoint between the upper and lower 3 dB wavelengths.



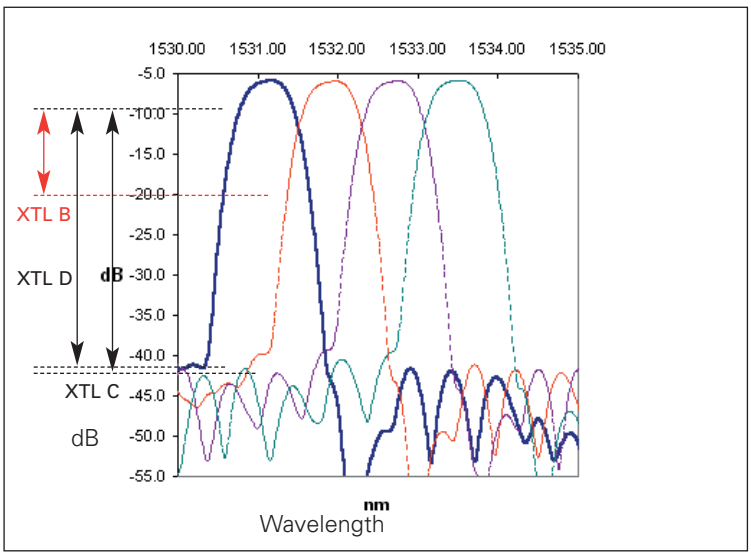
Bandwidth

Measures bandwidth at three different user-defined levels. The low-loss bandwidth (BW1 in the software) determines the passband of the device and calculates IL, ripple and crosstalk.



Crosstalk

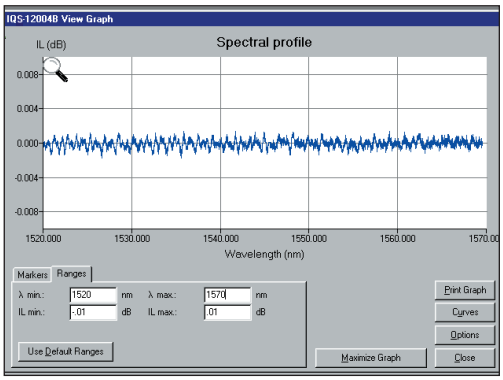
Measures crosstalk as the worst-case value, i.e., the difference between the highest loss in-band (channel A shown on the right) and the lowest loss in the bands of adjacent channels. The software allows the bands to be either defined or measured.



Results That Speak Volumes

INSERTION LOSS ACCURACY

The IQS-12004B system can measure insertion loss (IL) as a function of wavelength for any passive component over the C-band or the C+L-band. The measurement shown was made soon after a reference was performed with a patchcord connected directly between the WRM and the optical power meter. An ideal response would be a perfectly flat line at 0.000 dB. According to the data collected, the measurement ripple is around 0.001 dB. This indicates the level of performance that can be expected under ideal conditions.

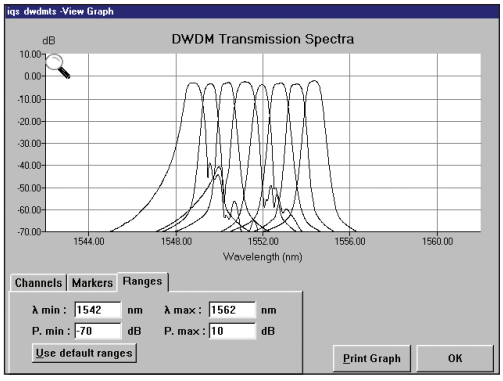


OUTSTANDING DYNAMIC RANGE

The IQS-12004B system also has an excellent dynamic range or optical rejection ratio (ORR) as shown by the filter measurement opposite. To achieve this type of dynamic range from a fast single measurement scan, many parameters have to be considered.

This is what you will need:

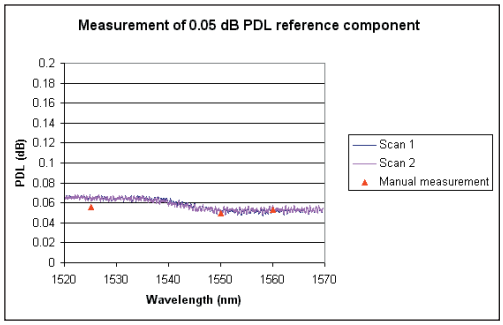
- A very low noise tunable laser source
- A fast autoranging optical power meter
- A high sensitivity optical power meter



ACCURATE PDL VS. WAVELENGTH MEASUREMENT

It is becoming increasingly important to be able to measure PDL as a function of wavelength for many DWDM passive components. For bandpass components, PDL must be measured across the passband. For other components, such as attenuators or gain equalization filters, it is important to measure PDL across the entire range.

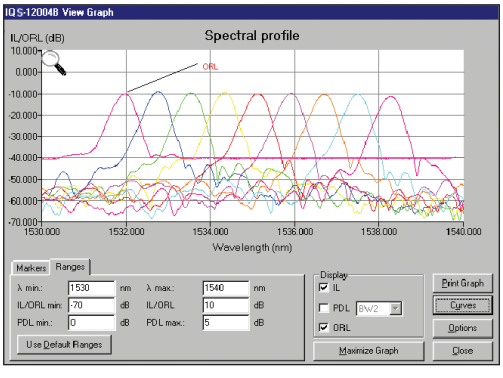
The IQS-12004B uses the Mueller Matrix four-state method. The graph shown opposite plots data from a nominal 0.05 dB PDL specimen measured by both the IQS-12004B and a polarization-scrambling apparatus. As can be seen, there is very close correlation, in addition, measurement repeatability is exceptional.



ORL MEASUREMENT AS A FUNCTION OF WAVELENGTH

The IQS-9401 Wavelength Reference Module has a return loss measuring detector connected to the output coupler. The ORL circuit uses an optical continuous wave reflectometer (OCWR) with a tunable light source, allowing ORL to be measured as a function of wavelength.

An added advantage of this configuration is the ability to measure the reflected spectrum of an FBG without requiring an additional coupler or circulator.



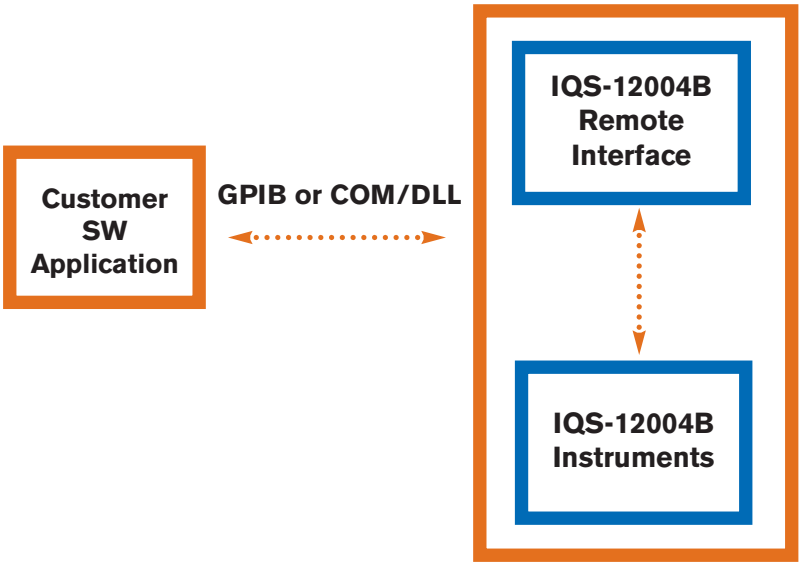
Total Flexibility

The IQS-12004B Passive Component Test System comes with a complete software package that gets you up and running the day the system is installed. EXFO developed the GPIB and COM/DLL remote interfaces to enable easy and efficient integration of the IQS-12004B system into your software applications. Simple, high-level commands allow even novice programmers to quickly develop customized testing routines with either interface.

GPIB REMOTE INTERFACE

Perform insertion loss and PDL measurements with a simple GPIB command (e.g., ACQ: ILPDL). The IQS-12004B remote interface interprets this command and controls all instruments. EXFO's done all the hard work for you.

A complete set of commands is available, comprised of initialization, calibration, IL, ORL, PDL measurements and many individual instrument controls.



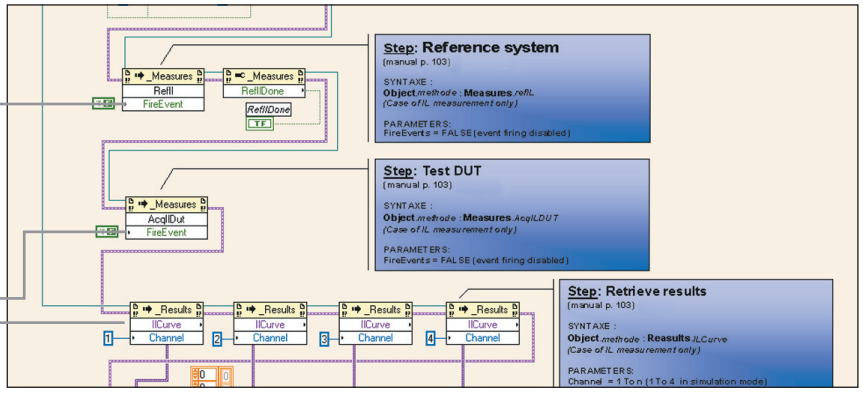
COM/DLL REMOTE INTERFACE

Achieve greater programming efficiency. All system functions are also available for direct DLL control, either locally or over an Ethernet (DCOM) connection. Additional productivity gains are also observed because the GPIB bus is no longer required and is replaced by either direct memory transfer or a network link.

Perform reference

Perform IL measurements

View results



Simple LabVIEW™ example using direct DLL control

SIMULATION MODE

Develop software applications without tying up costly hardware by initializing the IQS-12004B remote interface in Simulation mode. This mode also allows several programmers to develop software in parallel.

NEW IQS-12004B MULTIPATH TESTING OPTION

Take advantage of this new option to perform Telcordia qualification of DWDM filters and branching devices as well as VOA arrays and photonic switches of all technologies. Refer to the new specs sheet of IQS-12004B-MPT option.

Calibration Tools

The IQS-12004B is factory-calibrated and/or verified for power linearity, insertion loss, polarization-dependent loss, optical return loss, as well as wavelength.

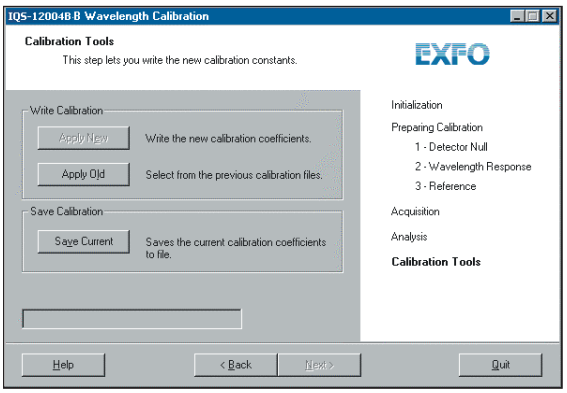
To ensure that the system remains within specifications, EXFO recommends performing wavelength and linearity calibration at least once a year. EXFO offers calibration tools to perform on-site calibration and verification.

WAVELENGTH CALIBRATION AND ADJUSTMENTS

To comply with the technical specifications of the system, the setup must be calibrated against a NIST traceable gas cell (CKT-01 HCN Wavelength Reference Cell). EXFO offers wavelength-calibration software with a step-by-step procedure to analyze and make wavelength adjustments if necessary.

Accessories required to perform wavelength calibration:

- CKT-01 HCN Wavelength Reference Cell



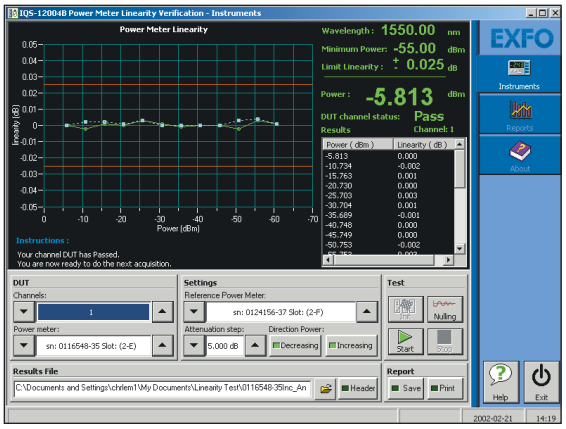
IQS-12004B Wavelength Calibration Software

OPTICAL POWER METER LINEARITY CALIBRATION

The power meter linearity calibration tool has been designed to verify the linearity of the IQS-12004B's power meters, ensuring that you get the best possible results from the system. For optimum accuracy, it is recommended that a linearity verification of optical power meters be performed at least once a year. The software tool is supplied to perform the whole linearity verification procedure with pass/fail analysis. The optical power meter linearity calibration is accomplished by comparing values from the power meter under test to the readings of a reference power meter. Results are available in table format and standard reporting is available.

Accessories required for linearity verification (CKT-20, CKT-21):

- IQS-3100 Variable Attenuator
- IQS-9600 50/50 Coupler
- Optional IQS-1643T Reference Power Meter



IQS-12004B Power Meter Linearity Verification Software.

SPECIFICATIONS

Specifications [a]

	IQS-2600CT
Testing time [b]	< 18 s for 1 channel
	< 25 s for 40 channels
Sampling resolution [c]	0.005 nm, 0.01 nm, 0.02 nm, and 0.04 nm
Wavelength uncertainty [d]	± 0.005 nm
Wavelength repeatability [d] (2s)	± 0.001 nm
Wavelength range	1511 nm to 1611 nm
Loss measurement uncertainty [e, f]	± 0.05 dB (0 to 50 dB loss)
Loss measurement repeatability [e, f]	± 0.01 dB (0 to 50 dB loss)
Loss measurement range [f]	0 to 75 dB
Loss measurement resolution	0.001 dB
Optical rejection ratio [g]	> 60 dB
PDL measurement resolution	0.001 dB
PDL uncertainty [f, h]	1520 nm to 1570 nm ± (0.02 dB + 5 % of PDL DUT)
	1511 nm to 1611 nm ± (0.03 dB + 5 % of PDL DUT)
PDL range	0 to 10 dB
ORL uncertainty [i]	± 0.5 dB (0 to 45 dB)
	± 1 dB (45 to 50 dB)
ORL range [i]	0 to 65 dB
Number of channels [j]	> 80
Operating temperature	23 °C ± 3 °C
Storage temperature	–10 °C to 50 °C

NOTES

a. All uncertainties are reported with a level of confidence [a] 95 %, after 60 minutes operating at constant temperature.

b. Testing time calculated for a single Insertion Loss measurement using a system with a Pentium III processor and includes data processing time for 1 channel (unless otherwise specified) at a sampling resolution of ≥ 0.01 nm over a range of 50 nm. For PDL test time, 3 additional scans are required. For ORL, 1 additional scan is required.

c. This is a typical value; actual sampling resolution may vary across the scan.

d. Applies to 0.005 nm and 0.01 nm sampling resolution, after user calibration.

e. Valid for a spectrally uniform component. Does not include uncertainties due to connector or connector adapter.

f. With > –5 dBm input to the DUT.

g. For DWDM bandpass components designed for ≤ 100 GHz channel spacing.

h. Valid after performing a Null measurement and a Reference measurement on a low loss spectrally uniform component terminated with a non-angled connector. Does not include uncertainties due to connector or connector adapter.

i. Specified without the IQS-5150 Polarization State Adjuster connected in the optical path. With the IQS-5150 connected, the reduction in the dynamic range is ≈ 5 dB.

j. For more channels call factory.

Standard Accessories

Industrial PentiumIII, 866 MHz, 256 MB memory, 10 GB hardisk, 10 slots, Ethernet Interface, Keyboard/mouse, CD-ROM standard, rackmount bracket.
IQS-9401 Wavelength Reference Module
ORL reflection reference
IQS-12004B software
Interconnecting patchcords
User guide
Calibration certificate
DLL control

Options

I3	GPIB/master card
CKT-01	HCN wavelength reference cell
CKT-20	Power meter linearity verification hardware (without reference power meter)
CKT-21	Power meter linearity verification (with reference power meter)
Monitor	17 inch video monitor

On-site calibration service available on request

ORDERING INFORMATION

IQS-12004B-MM-MM-PP-MM-MM

MM: Source option
S2 = IQS-2600CT
S3 = External source (call factory)

MM: Polarization option
00 = None
P1 = PDL option

PP: Number of expansion units
10E = 1 additionnal expansion
20E = 2 additionnal expansions
30E = 3 additionnal expansions

MM: Options
00 = None
I3 = GPIB master/slave

MM: Number of channels
04 = 4 channels
08 = 8 channels
12 = 12 channels
16 = 16 channels
XX = multiples of 4 up to 80
For more channels, call factory.

Find out more about EXFO's extensive line of high-performance portable instruments by visiting our website at **www.EXFO.com.**

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