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The JDS Uniphase SWS2000 is a fast, accurate and flexible test solution for characterizing the wavelength dependence of passive optical components. The SWS system consists of: a tunable laser source, a source optics module, a receiver chassis, a control module, and one or more detector modules and application software.

With a ± 0.002 nm absolute wavelength accuracy over the whole 1420-1630 nm range, a high sweep speed of 20 nm/s, the SWS2000 provides the maximum economical performance available; the distributed architecture supports up to eight separate, independently controlled measurement stations per transmitter. The SWS2000 can be applied to the measurement of any passive fiberoptic device with up to 128 output channels at each measurement station. Such devices include couplers, splitters, isolators, WDM, DWDM, attenuators, switches, fiber Bragg gratings, waveguide devices, wavelength lockers, gain flatteners and interleavers.

The SWS2000 wideband system combines a 1520-1630 nm laser with a 1420-1530 nm laser in a single system to provide seamless S+C+L-band measurements from 1420-1630 nm. For only C+L-band or S-band operations, the SWS17100 or SWS18100 laser can be purchased separately. The other band can be included later by the simple addition of the appropriate laser.



Key Features & Benefits

Reduces production test cost

± 0.002 nm absolute wavelength accuracy

High speed scanning (up to 40 nm/s) over 1420-1630 nm range

Distributed architecture

Up to 128 detector channels for device characterization

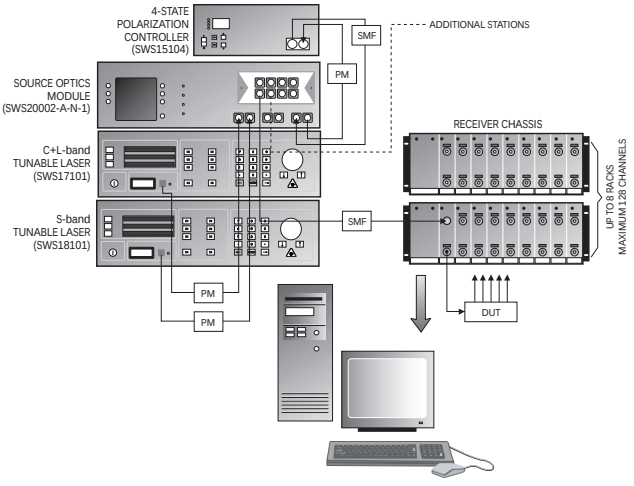
Flexible easy-to-use software

Customized applications through dynamic link libraries (DLLs)

24/7 service and support

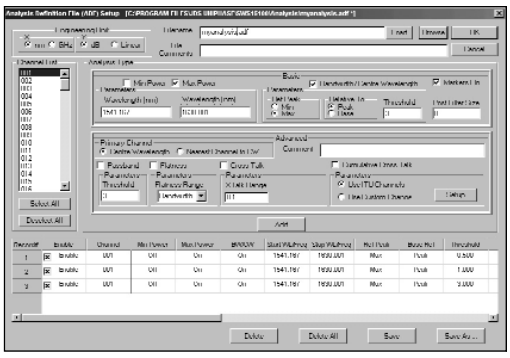
Applications

Passive optical component and fiber characterization in lab and manufacturing environments.

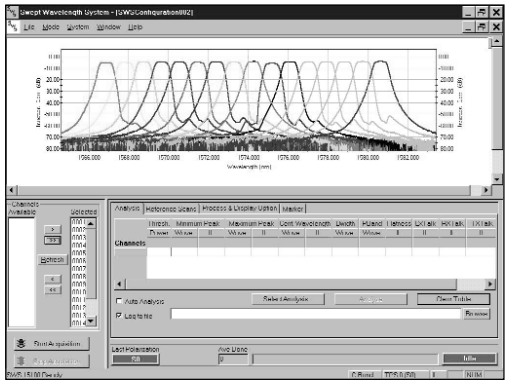


Typical Configuration of SWS2000

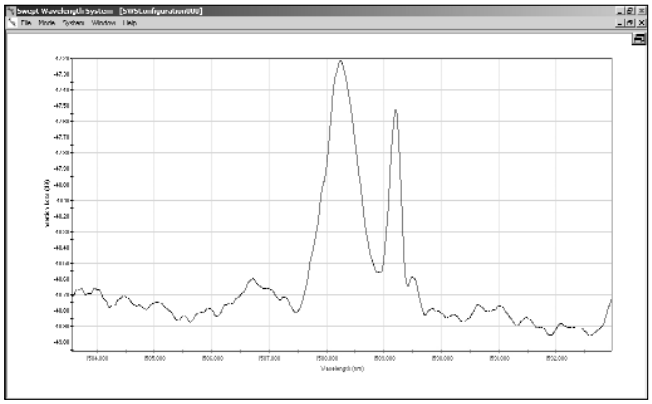
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Analysis Setup Window



Data Display and Control Window



Return Loss Measurement with SWS2000

SWS directly measures insertion loss (IL) as a function of wavelength as well as directivity and return loss (using SWS20005 Return Loss Module) and, with a polarization controller, polarization dependent loss (PDL) and average IL. The software for the SWS2000 provides a comprehensive set of analysis tools that calculate:

Loss at peak
Center wavelength, from x dB threshold
Loss at center wavelength
Bandwidth at x dB threshold
Crosstalk, left/right and cumulative
Flatness

These parameters are calculated relative to the measured peak, ITU grid or user-defined grid. All appropriate measurements are also available for PDL when the optional polarization controller is used. Parameters can be expressed in wavelength or frequency.

The swept wavelength system is delivered with a set of dynamic link libraries (DLLs) that can be used to develop software to suit custom testing requirements. The DLLs function through the SWS receiver hardware, allowing access to all SWS functionality. Using the supplied DLLs, applications may be developed in Visual Basic, C, C++, or LabView environments.

With a 4-State polarization controller, PDL and average loss are measured quickly as a function of wavelength. Four polarization states at 0°, 90°, - 45° and circular polarization are measured, and Mueller matrix analysis is used to accurately determine PDL at all wavelengths scanned.

When the very highest accuracy PDL measurements are required, a special version of the Detector Module should be used. The SWS15107-A contains specially selected and tuned components to allow PDL measurement to an accuracy of better than ±0.01 dB This module is supplied with a fixed FC/APC connector.

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Specifications

SWS2000 PERFORMANCE	SINGLE OUTPUT SOURCE OPTICS MODULE
Wavelength range	1520–1630 nm CL-band 1420–1530 nm S-band
Absolute wavelength accuracy	± 2 pm
Measurement resolution[1]	1 pm
Wavelength sampling resolution	3 pm
Insertion loss measurement accuracy[2,3] including polarization state averaged IL	± 0.05 dB (0–25 dB device insertion loss) ± 0.10 dB (25–45 dB device insertion loss) ± 0.20 dB (45–65 dB device insertion loss)
Dynamic range[3]	> 70 dB
Loss measurement repeatability[2]	± 0.02 dB
Loss measurement resolution	0.01 dB
Return loss measurement range[3,4]	60 dB
PDL measurement accuracy[2] SWS15107	± 0.05 dB (0–20 dB device insertion loss) ± 0.10 dB (20–40 dB device insertion loss)
PDL measurement accuracy[2] SWS15107-A with 13-point smoothing and 4 averages[1]	± 0.01 dB (0–20 dB device insertion loss) ± 0.03 dB (20–40 dB device insertion loss)
PDL measurement repeatability[1]	± 0.01 dB
PDL measurement resolution[1]	0.01 dB
Maximum slope resolution	10 dB/pm (0–35 dB device insertion loss)
Measurement time	9 s + 0.5 s per channel
Scan speed[5]	20 nm/s
Fiber type	SMF-28
Maximum outputs from DUT measured	128
Measurement stations per transmitter	up to 8, in 1, 2, 4, or 8 steps
Detector adapters[6]	FC, PC, ST, LC, bare fiber
Input voltage	110 to 230 V AC , 50 to 60 Hz
Receiver control	Custom interface for Win95/98/2000/XP
Receiver communication with computer	National Instruments PCI interface card
Dimensions (W x H x D)	
Source optics module (SWS20002-A-N)	48.3 x 13.3 x 37.5 cm
Tunable laser source (SWS17101/SWS18101)	48.3 x 13.3 x 43.2 cm
Receiver chassis (OWB10002)	48.3 x 13.3 x 46.0 cm
Polarization controller (SWS20007)	18.5 x 14.7 x 31.2 cm
Operating temperature	15 to 35 ºC
Storage temperature	0 to 70 ºC
Operating humidity	80 % RH maximum, non-condensing

1. Wavelength resolution defined as the minimum calculated center wavelength shift.
2. Does not include influence of connector.
3. Device insertion loss range /dynamic range both reduced for multiple output SOM.
4. Return Loss Module SWS20005 required.
5. 10 and 40 nm/s also selectable.
6. High PDL accuracy Detector Module SWS15107-A, using FC/APC only.

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SWS-OMNI

With the simple addition of an RF modulator and an OMNI Receiver, an existing SWS2000 system can be used to measure Group Delay and Differential Group Delay.

Existing test stations can continue to be used.

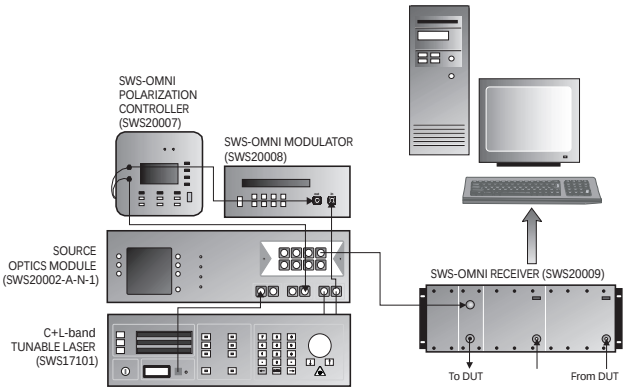
SWS-OMNI adds to the SWS family of test systems and provides leading-edge performance for fast all-parameter testing for efficient engineering, research and development, and production testing operations. SWS-OMNI rapidly and accurately measures Insertion Loss (IL), Polarization Dependent Loss (PDL), Group Delay (GD) and Differential Group Delay (DGD) characteristics of a wide range of passive optical components and optical fiber using a dual channel receiver for higher-throughput and lower-cost testing.

The modular architecture of the SWS-OMNI enables a user to add the SWS-OMNI receiver to an existing SWS transmitter to provide a stand-alone all parameter test station without the added expenditure of another tunable laser and wavelength meter. These additional test stations are purchased at a relatively low incremental cost providing best multi-station capital expenditure economics in the industry.

From phase and IL measurements, SWS-OMNI software calculates CD, PDL, GD and DGD as a function of wavelength or frequency. Displayed data may be further analyzed on-screen using markers, or setup to automatically analyze the data in the parameter ranges defined. This data can exported for further analysis. The software also has dynamic link libraries (DLLs) that can be used to easily develop custom software in LabVIEW, Visual Basic or C+, a feature that is especially useful in a production environment.

SWS-OMNI VIRTUAL MODULATION FREQUENCY FEATURE (VMFF)

To improve the group delay noise and resolution, conventional modulation phase measurement techniques often employ an adjustable modulation frequency, which needs to be set before measurements are made. In contrast, the SWS-OMNI system uses the proprietary VMFF. All swept group delay measurements are made at a fixed modulation frequency (192 MHz) optimized for the 3 pm wavelength sampling step of the SWS, the data is then post-processed to achieve higher effective modulation.



Key Features & Benefits

Virtual Modulation Frequency Feature (VMFF) - flexible post-processing

Measures IL, PDL, GD, DGD with a single bench or rackmountable receiver

Distributed Architecture - Add additional measurement stations at any time

Wideband scanning 1520 to 1630 nm, in one sweep

High speed; two-channel device characterization over

C-band or C+L bands for simultaneous measurement of all parameters.

Calibrated to NIST CD and PMD standards

Powerful engineering software package + DLL library - custom software applications

Applications

Passive optical component and fiber characterization in lab and manufacturing environments.

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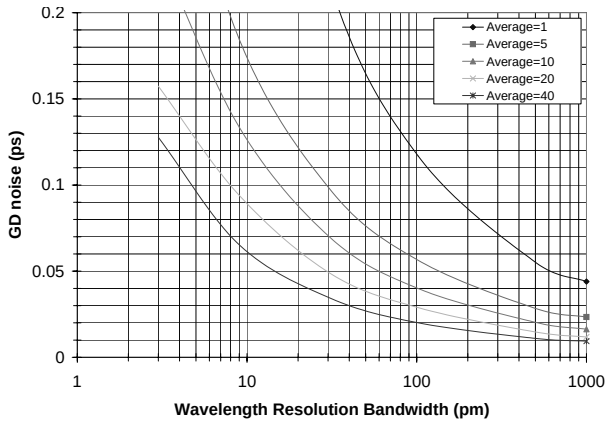
SWS-OMNI Specifications

PARAMETER		SPECIFICATION
WAVELENGTH		
Measurement range C-band		1520 - 1570 nm
Wavelength span		50 nm
Measurement range L-band		1541 - 1630 nm
Wavelength span		89 nm
Measurement range C+L-band		1520 - 1630 nm
Wavelength span		110 nm
Absolute accuracy		± 2 pm
Wavelength sampling resolution		3 pm
Measurement resolution[1]		1 pm
INSERTION LOSS[2,3]		
Dynamic range		45 dB
Accuracy	(0 to < 5 dB)	± 0.05 dB
	(5 to < 25 dB)	± 0.10 dB
	(25 to 45 dB)	± 0.25 dB
Resolution		0.01 dB
GROUP DELAY[2,3]		
Dynamic range		20 dB
Accuracy	(at < 10 dB IL)[4]	1.5 % typical
Uncertainty[5]		See attached performance curves
Modulation frequency[6]		192 MHz or greater
Max slope		800 ns/nm
POLARIZATION DEPENDENT LOSS[2]		
Dynamic range		45 dB
Accuracy	(0 to < 10 dB)	± 0.05 dB
Resolution		0.01 dB
DIFFERENTIAL GROUP DELAY[2]		
Dynamic range		20 dB
DGD uncertainty[5]		See performance curves below
PMD accuracy (typical)[7]		± 0.02 ps

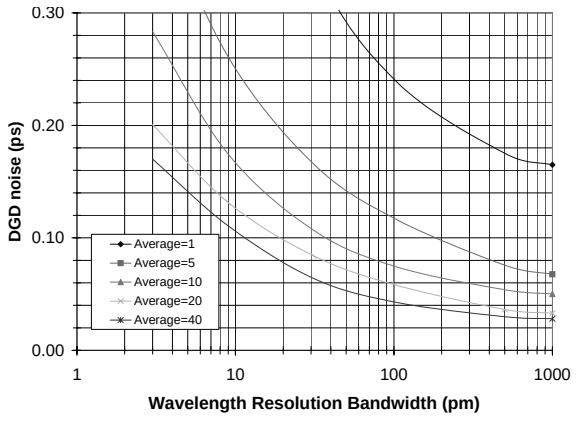
1. Measurement resolution is defined as the smallest shift in wavelength that can be detected using the analysis function.
2. Measured using SWS-OMNI transmitter under optimal power output.
3. Polarization state averaged.
4. Maximum deviation from NIST standard reference 2524.
5. Indicated uncertainty at 99.7% confidence level (3σ).
6. Theoretically no upper limit.
7. Based on the measurement of NIST standard reference 2518 (Mode-coupled PMD artifact, wavelength range 1520.5 to 1568.5 nm, DGD ~ 329 fs).

Performance Curves

Typical Group Delay Performance Curves (3σ)



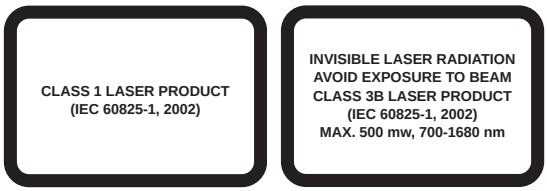
Typical Differential Group Delay Performance Curves (3σ)



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Safety

Complies to CE requirements plus UL3101.1 and CAN/CSA-C22.2 No. 1010.1. The laser source in the Source Optics Module (SWS-20002-A) is a class 1 laser. The Tunable Laser Source (SWS-17101 and SWS18101) is a class 3B laser. Both are classified per IEC standard 60825-1 (2002) and comply with FDA standard 21CFR 1040.10 except deviations per Laser Notice No. 50, July 2001.



Ordering Information

Please contact a JDS Uniphase customer service representative to order or upgrade an SWS2000 system.

Optional Accessories

Part Numbers	Description
AC100	Detector cap
AC101	FC detector adapter
AC102	ST detector adapter
AC103	SC detector adapter
AC115	E2000 detector adapter
AC118	LC detector adapter
AC120	Magnetic detector adapter
AC121	Bare fiber holder (requires AC120)
AC320	Integrating sphere
J-FAFP-B-001	FC/APC to FC/PC jumper cable, 1 m
J-FASP-B-001	FC/APC to ST/PC jumper cable, 1 m
J-FASC-B-001	FC/APC to SC/PC jumper cable, 1 m
J-FASU-B-001	FC/APC to SC/APC jumper cable, 1 m
OWB10001-A	Single laser transmitter cabinet
OWB10001-B	Dual laser transmitter cabinet
OWB10002	Receiver chassis

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ST is a registered trademark of Lucent Technologies.
Visual Basic is a registered trademark of Microsoft Corporation.

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