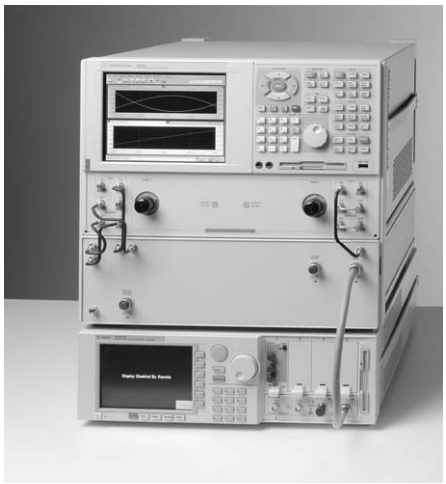
Agilent 86038B
Photonic
Dispersion and Loss Analyzer
Fast and Accurate Spectral Analysis

Technical Specifications
January 2007



Simultaneous measurements of:

Group Delay (GD), Optical Phase,
Chromatic Dispersion (CD) and Length;
Differential Group Delay (DGD) and
Polarization Mode Dispersion (PMD),
including 2nd-Order PMD;
Insertion Loss (IL), and
Polarization Dependent Loss (PDL)
of fiber, components, amplifiers and links.

- Very high accuracy and resolution
- Extremely fast swept measurements
- Up to 4 port device testing
- No CD error due to PMD
- Flexible wavelength range choices from 1260 to 1640 nm (O to L band).

Agilent Technologies

Agilent 86038B Photonic Dispersion and Loss Analyzer accelerates development of the next generation networks

If you are involved in optical communications design or manufacturing, whether at component, subsystem or system level, you know the challenges you face are complex. These challenges are driven by the use of higher data transmission rates (10 Gb/s and 40 Gb/s), dense and coarse wavelength division multiplexing (DWDM or CWDM), and wide wavelength range.

Overcoming dispersion is a major complication in deploying and upgrading 10 Gb/s and 40 Gb/s networks. Chromatic dispersion can limit the performance of optical components and signals. This is a problem at 10 Gb/s and a bigger one at 40 Gb/s. Like chromatic dispersion, polarization mode dispersion also degrades fiber optic transmission performance. It is caused by birefringence in the optical transmission medium, and causes polarization modes of a signal to travel at different group velocities. The precise characterization of dispersion and loss properties for fibers, components and systems becomes mandatory at data rates above 10 Gb/s.

The 86038B Photonic Dispersion and Loss Analyzer provides the required accuracy and repeatability for 10 Gb/s and 40 Gb/s system reliability.

The value that the Agilent 86038B Photonic Dispersion and Loss Analyzer offers is its ability to perform highly accurate measurements of group delay (GD) and chromatic dispersion (CD), differential group delay (DGD) and 1st and 2nd order polarization mode dispersion (PMD), insertion loss (IL) and polarization dependent loss (PDL) with a single set-up and connection for minimum test uncertainty and time to increase throughput and reduce cost of test. The 86038B is the ideal solution for R&D and manufacturing requirements for measurement of optical fiber, dispersion compensating gratings, DWDM and CWDM components, amplifiers and links.

Agilent has always been relentless in helping you meet your design challenges. Using an innovative technique developed by Agilent, enhancing the industry-standard modulation phase-shift (MPS) technique, the 86038B achieves best-in-class accuracy and repeatability with fast swept-wavelength measurements. The instrument allows optimizing the wavelength resolution to your needs and provides both high resolution and low trace noise at high speed. The 86038B also offers a real-time data update mode (continuous sweep) for fine-tuning devices.

Key Capabilities

Simultaneous GD, CD, DGD, PMD, IL, and PDL spectra with a single connection and a single setup reduce test time, instrument footprint and measurement uncertainty.

CD uncertainty: ± 0.07 ps/nm; ± 0.3% CD
Zero dispersion wavelength uncertainty: ± 0.015nm
Group delay repeatability: < ±0.03 ps (< ±30 fs)
PMD uncertainty: ±0.07 ps
Differential group delay uncertainty: ± 100 fs
Enhanced PDL and insertion loss accuracy: PDL < 0.05 dB, Loss < 0.02dB
Extremely high speed swept measurements:
DGD measurements over 100nm can be obtained in less than 30 seconds.
GD/CD measurements automatically corrected for PMD
Allows very accurate CD measurements
6 polarization-state measurements
This selectable method adds additional accuracy to polarization measurements, especially over wide wavelength ranges
Up to 4-port component testing:
Agilent's 81595B Modular Optical Switch allows testing of up 4 ports of a multichannel DUT.
Wide dynamic range: > 40 dB
Flexible choice of wavelength range:
from 1260 nm to 1640 nm
Supports multiple wavelength band operation
by controlling up to 4 tunable lasers. Automatic laser switching is available on request.
Drift correction:
Provides excellent stability and accuracy when the environmental conditions of the room or the test device are gradually changing.
Selectable and high wavelength resolution:
Resolution to <0.2pm for challenges like GD ripple characterization and up to 2.5 GHz MPS modulation frequency for lowest noise fiber characterization.
Powerful remote control:
Write your own applications for enhanced measurement control and analysis
Removable spare hard drive:
Allows protection of your sensitive data.
1 year warranty:
Industry leading 1 year warranty is offered standard on all 86038B Photonic Dispersion and Loss Analyzers.

Agilent 86038B
An innovative solution for simultaneous dispersion and loss measurements

The 86038B was designed for a wide range of test needs including optical fiber, dispersion compensators, wavelength-dependent components, amplifiers and systems.

The 86038B Photonic Dispersion and Loss Analyzer is based on the Agilent N5230A Performance Network Analyzer (PNA-L) and Agilent 81600B tunable laser source. The PNA-L provides low-noise phase and amplitude measurements and flexible choice of modulation frequency from 5 MHz to 2.5 GHz for optimizing to any dispersion level and wavelength resolution. The Agilent 81600B provides specified wavelength accuracy and stability, even during high-speed sweeps.

Polarization-dependent measurements are achieved with optics that minimize the wavelength dependence and maximize the reproducibility. An optimized choice of polarization states and selectable use of six input polarization states provide optimum accuracy of the results obtained by matrix analysis, even over very wide wavelength ranges. A new analysis algorithm is used to decouple the influence of DGD and PDL.

The Enhanced PDL and Loss Option adds Agilent's highest performance power sensors to the instrument for sensitive optical power detection with minimum polarization dependence. This delivers the PDL accuracy familiar from Agilent's industry standard spectral loss and PDL measurement solutions based on a tunable laser and optical power meters using the Mueller Matrix method.

Highly accurate and repeatable Group Delay (GD) and Differential Group Delay (DGD) measurements

The 86038B uses the industry-standard Modulation Phase Shift (MPS) method for both GD/CD and DGD measurements. This implementation of the MPS method delivers both high GD and wavelength resolution. The basic method is standardized in IEC 60793-1-42. The method is documented for DGD and PMD in other standards such as IEC 61280-4-4. This is the one method that can determine a DGD value from measurements only at that wavelength, allowing high resolution with low noise.

The 86038B uses fast swept measurements that are ideal for manufacturing. On the manufacturing floor, success depends on high volume throughput, fast ramp-up and reduced cost of test. Trust in your results is vital. The MPS method used on the 86038B avoids sensitivity to thermal drifts and mechanical vibrations. And the Drift Correction feature assists in obtaining repeatable and stable measurements even in an unstable environment.

Advanced polarization analysis

The 86038B Photonic Dispersion and Loss Analyzer uses swept or stepped wavelength measurements with 4 or 6 input polarization states in combination with matrix analysis. Besides DGD, PMD and PDL, this provides complete PMD vector and 2nd-order PMD and the top row of the Mueller Matrix. The exported matrix data can be used to extract TE and TM spectra, polarization-dependent wavelength (PDW) of filters and determine the contribution of GD ripple to DGD.

CD measurements automatically corrected for PMD

CD measurements can vary with the polarization of the light due to DGD, which limits the accuracy of the measurement. The inherent uncertainty can be up to half of the differential group delay. The 86038B takes advantage of multiple sweeps at distinct states of polarization to evaluate the impact of DGD on the group delay and remove it, allowing the system to produce group delay and CD traces that are free of the effects of DGD.

Fast and accurate length measurement

In a few seconds, the fiber or device length can be determined, short or long. The measurement, according to the standard IEC 60793-1-22 and using the modulation frequency range of the 86038B supports determination of CD and PMD coefficients of fiber, the dependence of dispersion on length.

Excellent optical resolution for narrow band devices

The 86038B Photonic Dispersion and Loss Analyzer can perform measurements with modulation frequencies as low as 5 MHz with wavelength steps of 0.1 pm. The extremely low noise floor on the PNA-L combined with phase dynamic accuracy corrections enables measurements with high accuracy and repeatability at low modulation frequencies. The very high-resolution capability of the 86038B enables measurements of group delay ripple.

Optical phase

Optical phase traces are also calculated as the integral of GD. Deviation from linear or quadratic phase are easily displayed, similar to GD ripple.

High speed dependable measurements

The 86038B allows fast group delay, chromatic dispersion and insertion loss measurements in swept-wavelength mode. The high-speed measurements minimize environmental influences that affect accuracy. A continuous sweep mode that provides real-time data update is also provided for fine-tuning of devices in R&D and manufacturing.

Extremely high wavelength accuracy

The high absolute and relative wavelength accuracy derive from the Agilent 81600B tunable laser with internal wavelength monitoring and control. Especially important for swept measurements of devices with high CD, the 81600B wavelength accuracy is also specified during swept wavelength measurements, using triggers for synchronization with the analyzer.

If needed, further enhanced absolute wavelength accuracy is available using the Agilent 86122A Multiwavelength Meter to automatically measure and offset the tunable laser source's output wavelength. The 86122A can be ordered as an option on the 86038B. The 86122A can also be used for other measurement purposes when not being used for 86038B measurements.

Wide dynamic range

The 86038B has a dynamic range that can easily measure optical transmission amplitude characteristics of optical filters and other devices. Furthermore, the 86038B can also measure group delay and chromatic dispersion characteristic over a wide dynamic range. If required, the low-SSE output port of the tunable laser can be used to measure filter to high levels of wavelength isolation.

Easy to use solution for R&D and high volume manufacturing

This instrument is a stand-alone, compact bench-top solution, ideal for either a space-constrained R&D lab or manufacturing floor. The 86038B has an easy-to-operate user interface designed to meet the individual needs of R&D and manufacturing environments. Measurements can be acquired with the touch of a button.

The 86038B is designed for high throughput measurements over an entire wavelength band. The option for up to 4 ports enables automated measurement of multiport components in transmission or using a coupler also in reflection. The 86038B displays a maximum of eight traces simultaneously.

Since manufacturing test equipment is primarily used remotely, instrument control must be easy, reliable and robust. The 86038B offers complete instrument control using .NET via LAN interface. The LAN interface provides for easy data storage via the network.

Extensive curve fitting and smoothing algorithms for group delay ripple analysis

The 86038B offers an extensive set of data processing and smoothing algorithms for post-processing of data. Custom curve fitting or smoothing algorithms can be easily imported into the 86038B as well. Ripple analysis is realized from the residual difference between original and fit data. The data can also be easily exported for data processing and smoothing.

Drift Correction feature provides excellent stability

The 86038B Photonic Dispersion and Loss Analyzer has a unique and powerful feature that can improve the accuracy of the system when the temperature of the room or the test device is gradually changing. If temperature is changing, the test paths and DUT length change with it, and the phase from which relative group delay is calculated also drifts. To reduce the drift, select the drift correction feature.

Real-time Port Monitor for connection, alignment and stability check.

The real-time port monitor allows observation of the loss and group delay in real time at fixed wavelength. It is a practical tool for coupling and alignment processes. Also with the real-time port monitor function the device stability and connection can be verified prior to the measurement process.

Continuous trigger sweep mode provides real time update of data

This mode simplifies fine-tuning, calibration and configuration of components.

Measurement capabilities

Group Delay (GD),
Chromatic Dispersion (CD),
Optical Phase,
Differential Group Delay (DGD),
Polarization Mode Dispersion (PMD),
2^{nd}-order PMD including Polarization Chromatic Dispersion (PCD) and depolarization rate,
Insertion Loss (IL)
Polarization Dependent Loss (PDL)
Zero-dispersion wavelength
Zero-dispersion slope
Device Length

Ordering Information

The 86038B Photonic Dispersion and Loss Analyzer is configurable to specific measurement requirements. Options for customer-provided TLS are also available for customers who have their own Agilent tunable laser source.

All options are available at the time of purchase. Contact your local Agilent field representative or Test and Measurement Services and Consulting Operations for details and quotes.

Agilent 86038B ordering options

At least one TLS option must be ordered with the instrument		
TLS Options	86038B – 120	CD/PMD/PDL/IL solution for S,C and L bands (1440 nm to 1640 nm using the Agilent 81600B-200 TLS)
	86038B – 116	CD/PMD/PDL/IL solution for C and L bands (1495 nm to 1640 nm using the Agilent 81600B-160 TLS)
	86038B – 115	CD/PMD/PDL/IL solution for S and C bands (1450 nm to 1590 nm using the Agilent 81600B-150 TLS)
	86038B – 114	CD/PMD/PDL/IL solution for E and S band (1370 nm to 1495 nm using the Agilent 81600B-140 TLS)
	86038B – 113	CD/PMD/PDL/IL solution for O band (1260 nm to 1375 nm using the Agilent 81600B-130 TLS)
	86038B – 320	Integration of customer-supplied Agilent 81600B-200 and 8164B*
	86038B – 316	Integration of customer-supplied Agilent 81600B-160 or 81640B TLS and 8164B*
	86038B – 315	Integration of customer-supplied Agilent 81600B-150 or 81680B TLS and 8164B*
	86038B – 314	Integration of customer-supplied Agilent 81600B-140 or 81480B TLS and 8164B*
	86038B – 313	Integration of customer-supplied Agilent 81600B-130 and 8164B*
Performance Options	86038B – 400	Enhanced PDL and Loss Accuracy
	86038B – 410	Add 86122A multi-wavelength meter for ± 1.0 pm accuracy
Accessories	86038B – 501	81591B 1x2 Modular Optical Switch for 2 Port Operation
	86038B – 505	81595B 1x4 Modular Optical Switch for 4 Port Operation
	86038B – 510	Verification Fiber
	86038B – 520	Spare Hard Drive

* Customer-supplied tunable laser sources must be returned to Agilent for qualification test, calibration and integration in the 86038B. The tunable laser must be equipped or retrofitted with the polarization maintaining (PM) fiber option. Tunable lasers found to be in need of repair or retrofit will incur additional cost to the customer. Contact the Agilent field sales staff for more information about performing retrofits.

Specifications [a]

Specifications apply to swept mode (if not stated otherwise)

Group Delay and Differential Group Delay [b]			
loss ≤ 4 dB	**loss ≤ 10 dB**	**loss ≤ 20 dB, typ.**	**loss ≤ 30 dB, typ.**
Relative Group Delay (rGD) Uncertainty [c],[d]			
± 50 fs	± 100 fs	± 350 fs	± 4 ps
Relative Group Delay (rGD) Repeatability [c],[d]			
± 30 fs	± 50 fs	± 300 fs	± 3.5 ps
Differential Group Delay (DGD) Uncertainty [e],[f]			
± 100 fs ± 2.5% of DGD	± 150 fs ± 3% of DGD	± 500 fs ± 2% of DGD	± 5 ps ± 12% of DGD
Differential Group Delay (DGD) Repeatability [e],[f]			
± 50 fs ± 1% of DGD	± 100 fs ± 2% of DGD	± 350 fs ± 1.5% of DGD	± 3.5 ps ± 12% of DGD
PMD Uncertainty (typical) [e],[f],[h]			
± 70 fs ± 2% of PMD	± 100 fs ± 2% of PMD	± 300 fs ± 2% of PMD	± 3 ps ± 4% of PMD
Modulation Frequency Range	5 MHz to 2.5 GHz		

[a] Ambient temperature change max. ± 0.5°C since normalization. TLS maximum power set to 0 dBm. Sweep over specified wavelength range. Specification does not include instability in test device. Specified loss ranges include loss of test device and any additional switches or connections in the optical path. Specification valid on day of calibration.

[b] Modulation frequency f_{mod} = 2 GHz. IFBW = 70 Hz, wavelength increment = 1 nm, PDA correction ON.
Note: for modulation frequencies, f_{mod}, different from 2 GHz, uncertainties typically scale by the factor "2 GHz/f_{mod}".

[c] GD/CD Swept Mode.

[d] Based on phase measurement uncertainties and modulation frequency uncertainty.
For rGD >> 1000 ps add ± 10^{-6} of rGD (contribution from modulation frequency uncertainty).

[e] DGD/PDL Swept Mode using 6 polarization states.

[f] Tested with a set of fibers (SMF and PMF) covering a range of DGD values. Specification is typical for DGD >50ps.

[h] Averaged over 50 nm wavelength span with wavelength increment ≤ 1 nm.

Length

Length Uncertainty	± (0.02 mm + 1x10^{-6} of length) typ.[i]

[i] Not including uncertainty of entered value for group refractive index. Specification valid for length ≤ 50 km, based on a refractive index of 1.4.

Amplitude[i]

Polarization Dependent Loss (PDL) Uncertainty[k]	Without Opt. 400: ± (0.15 dB + 3% of PDL) typ. With Opt. 400: ± (0.05 dB + 3% of PDL)
Gain/Loss Uncertainty	Without Opt. 400: ± (0.1 dB + 5% of loss)[l] typ. With Opt. 400: ± 0.02 dB (loss < 10dB) ± 0.04 dB (loss < 30dB)

[j] DGD/PDL Swept Mode using 6 polarization states, excluding connectors.

[k] Loss from 0 dB to 4 dB; Opt.400 specified over the specified range of the tunable laser option, but limited to within 1450-1625 nm.

[l] Loss from 0 dB to 40 dB.

Dynamic range

System dynamic range	> 40 dB typ.[m]

[m] For TLS power level 0 dBm. For higher power levels, the dynamic range increases correspondingly.

Wavelength

Wavelength Range[n]	
Opt. #120 or #320: With Agilent 81600B-200 Tunable Laser Source	1440 nm to 1640 nm
Opt. #116 or #316: With Agilent 81600B-160 or 81640B	1495 nm to 1640 nm
Opt. #115 or #315: With Agilent 81600B-150 or 81680B	1450 nm to 1590 nm
Opt. #114 or #314: With Agilent 81600B-140	1370 nm to 1495 nm
Opt. #113 or #313: With Agilent 81600B-130	1260 nm to 1375 nm
Minimum Wavelength Increment	0.1 pm

[n] PDLA specifications apply for sweeps within the following wavelength ranges. Excluding mode-hops. For the conditions for mode-hop free continuous sweeps, please see the tunable laser specifications in the tunable laser User's Guide.

Opt. #120 or #320: 1475 nm to 1625 nm,

Opt. #116 or #316: 1510 nm to 1620 nm,

Opt. #115 or #315: 1480 nm to 1580 nm,

Opt. #114 or #314: 1420 nm to 1490 (typical specifications),

Opt. #113 or #313: 1270 nm to 1350 (typical specifications).

Absolute Wavelength Uncertainty[o]		
Stepped mode	with Agilent 86122A	± 2 pm typ.
	without Agilent 86122A	± 10 pm, ± 3.6 pm typ.
Swept mode	with Agilent 86122A	± 4 pm typ.

	without Agilent 86122A	≤ ± 6.1 pm typ.

Relative Wavelength Uncertainty[o]	
Stepped mode	± 5 pm, ± 2 pm typ.
Swept mode	≤ ± 4 pm typ.

[o] Valid for one month and within a ± 4.4 K temperature range after automatic wavelength zeroing. For details, refer to tunable laser's wavelength uncertainty specification.

Chromatic Dispersion [t]

Specifications for selected wavelength resolution[u] $\Delta\lambda$

loss ≤ 4 dB	**loss ≤ 10 dB**	**loss ≤ 20 dB, typ.**	**loss ≤ 30 dB, typ.**
Chromatic Dispersion (CD) Uncertainty			
$\pm\frac{70\ fs}{\Delta\lambda}\pm\frac{0.003\ nm}{\Delta\lambda}\times CD$	$\pm\frac{140\ fs}{\Delta\lambda}\pm\frac{0.003\ nm}{\Delta\lambda}\times CD$	$\pm\frac{0.5\ ps}{\Delta\lambda}\pm\frac{0.003\ nm}{\Delta\lambda}\times CD$	$\pm\frac{6\ ps}{\Delta\lambda}\pm\frac{0.003\ nm}{\Delta\lambda}\times CD$
Example: ± (0.07 + 0.3% CD) ps/nm for 1 nm wavelength resolution, with a fiber of CD dispersion and loss ≤ 4 dB.			
Zero Dispersion Wavelength Uncertainty[w],[x]			
± 0.008 nm[v] $\pm\frac{0.007\ ps/nm}{ZDS}$	± 0.008 nm[v] $\pm\frac{0.014\ ps/nm}{ZDS}$	± 0.008 nm[v] $\pm\frac{0.05\ ps/nm}{ZDS}$	± 0.008 nm[v] $\pm\frac{0.6\ ps/nm}{ZDS}$
Example: ± 0.015 nm typ. for a fiber with zero dispersion slope ZDS = 1 ps/nm^2 and loss ≤ 4 dB.			
Zero Dispersion Slope (ZDS) Uncertainty [w],[x]			
$\pm 0.002 ps/nm^2 \pm 0.1\% \cdot ZDS$	$\pm 0.004 ps/nm^2 \pm 0.1\% \cdot ZDS$	$\pm 0.016 ps/nm^2 \pm 0.1\% \cdot ZDS$	$\pm 0.16 ps/nm^2 \pm 0.1\% \cdot ZDS$
Example: ± 0.003 ps/nm^2 for a fiber with zero dispersion slope ZDS = 1 ps/nm^2 and loss ≤ 4 dB.			
Repeatability of Chromatic Dispersion, Zero Dispersion Wavelength and Zero Dispersion Slope			
typ. < 60% of the respective uncertainty	typ. < 60% of the respective uncertainty	-	-

[t] Uncertainties derived from rGD uncertainty and from ± 2 pm relative wavelength uncertainty for $\Delta\lambda$ between 0.1 nm and 10 nm. Parameters and conditions as for rGD.

[u] Wavelength resolution $\Delta\lambda$ equals (wavelength increment ∗ selected smoothing width) (see manual). Valid for $\Delta\lambda$ between 0.1 nm and 10 nm.

[v] Typical without wavelength meter option. (± 0.006 nm with wavelength meter option.)

[w] For fibers. Determined by a curve fit over a wavelength range of 10 nm including the zero-dispersion wavelength, with wavelength increment ≤ 1 nm, assuming that the selected curve fit sufficiently represents the fiber dispersion curve (the fit does not contribute to the error).

[x] Method confirmed on NIST Standard Reference Material 2524.

Measurement time

30 s
(DGD/PDL swept mode with 4 polarization states, IFBW 70 Hz, 2 nm wavelength range and 10 pm wavelength increment, or 100 nm wavelength range and 1 nm wavelength increment)

Conditions

Maximum Safe Optical Input Power:
+4 dBm
Warm-up time:
90 minutes
Storage temperature:
-40°C to +70°C
Operating temperature:
+10°C to +35°C
Specified temperature:
+20°C to +30°C
Humidity:
< 80% r.h., non-condensing
Recommended re-calibration period:
1 year

General Characteristics

(Minimum configuration including one tunable laser)

Assembled dimensions: (H x W x D)

55.5 cm x 43.5 cm x 55.5 cm
(21.9 in x 17.2 in x 21.9 in)

Power Requirements

100 – 240 V~ 50 – 60 Hz
3 power cables
N5230A: max. 350 W
8164B (incl modules): max. 270 VA
83427C: max. 250 VA

Net weight

Standard system: 54 kg (120 lbs)

Documentation

The main system documentation is the operating manual that describes how to operate the Agilent 86038B. Individual instrument manuals will also be supplied with supplemental documentation of any special modifications. All documentation is shipped with the product but is also available on the Agilent web site at www.agilent.com/comms/lightwave

Warranty

All system warranties and support agreements are dependent upon the integrity of the Agilent 86038B. Any modification of the system software or hardware will terminate any obligation that Agilent Technologies may have to the purchaser. Please contact your local Agilent field engineer before embarking in any changes to the system.

System

Included in the sales price is an industry leading one-year warranty. In addition to the one-year warranty, extended warranty periods, on-site troubleshooting, reduced response times and increased coverage hours can be negotiated under a separate support agreement and will be charged at an extra cost.

Instruments and computers

The instrument standard support life period is five years. Application software is supported only on computer and instrument configurations specified at the time of installation.

Agilent Technologies' Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

By Internet, phone, or fax, get assistance with all your test & measurement needs

Online assistance:

http://www.agilent.com/comms/lightwave

For related literature, please visit:

http://www.agilent.com/comms/octsolutions

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