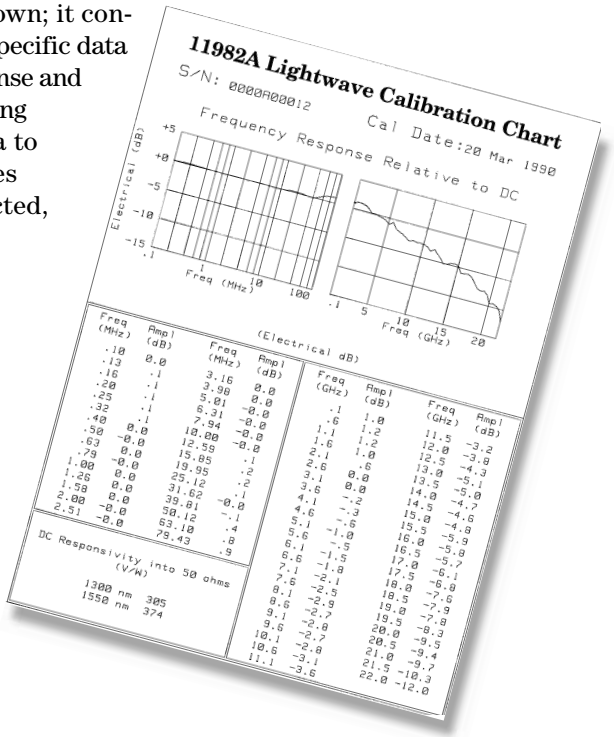
# Agilent 11982A
# Amplified Lightwave Converter
## Product Overview

**Wide bandwidth, sensitive O/E converter for characterizing lightwave systems and components**


Agilent's lightwave converter, the Agilent 11982A, combines a PIN photodetector with a low-noise preamplifier to provide a general-purpose front-end for lightwave frequency- and time-domain measurements. It can be used with Agilent spectrum analyzers, oscilloscopes, bit-error-rate testers (BERT), and network analyzers, as well as with other manufacturers' instrumentation.

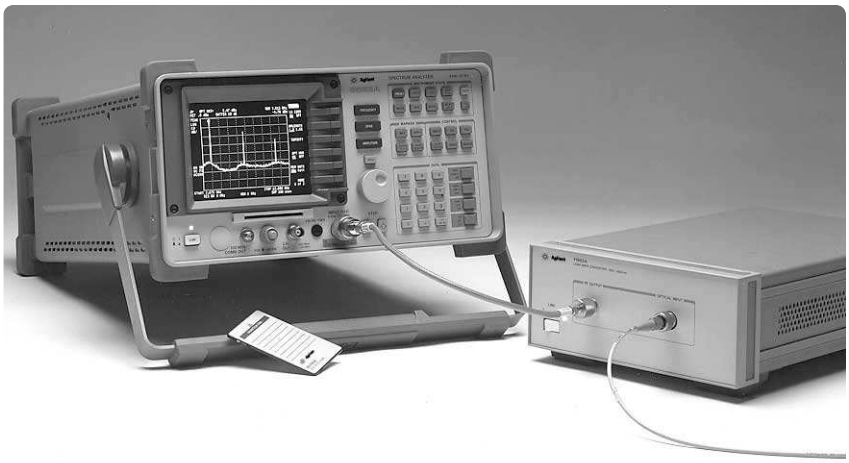
The Agilent 11982A covers the wavelengths from 1200 nm to1600 nm and bandwidths from dc to 15 GHz. Its 300 volts/watt conversion gain and 0.05% input optical reflection significantly improve sensitivity for characterizing lightwave systems and components.

A calibration chart is provided with each Agilent 11982A. A sample chart is shown; it contains instrument-specific data for frequency response and responsivity. Applying this calibration data to your system enables you to make corrected, accurate lightwave measurements.




**Agilent Technologies**

## Frequency Domain

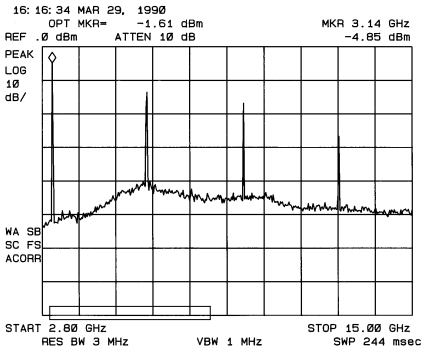


When used with an electrical spectrum analyzer, the Agilent 11982A displays optical modulation power as a function of frequency. Intensity modulation, distortion, and laser intensity noise can also be displayed and measured.

The laser's relaxation oscillation appears as a peaking in the intensity-noise floor of the laser. The location of this resonance peak is directly related to the maximum modulation rate of the laser. The 300 volts/watt conversion gain of the converter improves the frequency-domain sensitivity so that the relaxation oscillation frequency can be easily distinguished.

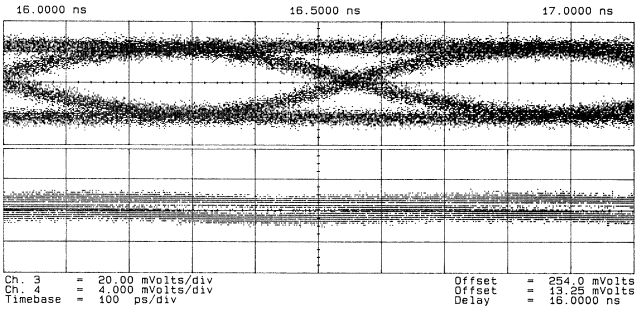
When a laser is modulated, its noise floor and modulation distortion products change dramatically. Often, knowing static noise performance is not enough to predict the effects of laser noise on the system. The Agilent 11982A and frequency-response corrections, combined with an Agilent electrical spectrum analyzer, help you accurately measure these changes and dynamically observe their effect.

The Agilent 11982A Option 001 is a memory card that is programmed with 11982A frequency-response corrections and lightwave menus. Use it with the Agilent 8594E or 8595E RF spectrum analyzer or Agilent 8593E microwave spectrum analyzer. Option 001 lets you load correction data and menus directly into the spectrum analyzer, enabling easy, accurate, and corrected frequency domain measurements to 22 GHz.



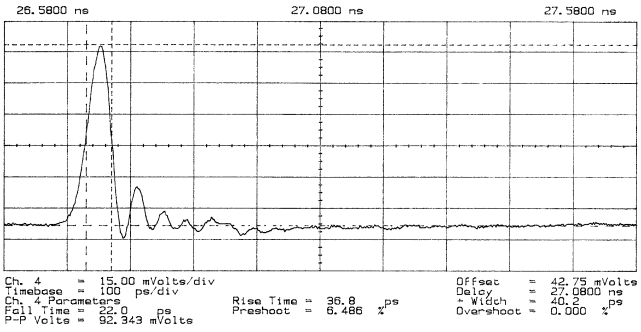

Adding the Agilent 11980A fiber-optic Mach-Zehnder interferometer to these configurations allows you to make linewidth, chirp, and frequency modulation (FM) measurements of single-line lasers.

## Time Domain




**Eye diagram with Agilent 11982A**

**Eye diagram with a photo diode only**




**Agilent 11982A impulse response**

Combining the dc-coupled Agilent 11982A with an Agilent 86100A Infiniium DCA (digital communications analyzer) provides the capability for optical eye-pattern, extinction-ratio, and impulse-response measurements. Use these measurements to verify optical and electro-optic components, optical system-level performance, and standards testing (i.e. SONET/ SDH, FDDI, and ISDN) on telecommunications signals.

Eye diagrams and extinction ratios help you to adjust your transmission system for the best qualitative performance. To make the most accurate measurements, the receiver systems require dc coupling, bandwidth, sensitivity, and variable and infinite persistence. DC coupling is essential for extinction-ratio measurements. Bandwidths typically must be at least four to five times the transmission data rate to reduce measurement errors. Eye diagrams cannot use the averaging feature of the oscilloscope to increase signal-to-noise ratios.

For best extinction ratio accuracy and repeatability, the Agilent 86100A, together with one of its broad range of optical plug-ins is recommended.

The presence of a preamplifier in front of the oscilloscope can be critical to boost the electrical signal detected by the photodiode above the oscilloscope's noise floor.

The variable and infinite persistence feature enables worst-case eye-pattern closure analysis without masking hidden low-probability tails.

You can also make impulse measurements such as full-width half-maximum (FWHM), jitter, overshoot, undershoot, and ringing. When measuring points in a communication system where signal levels are low, using an amplifier makes the difference between success or failure.

The Agilent 11982A provides dc coupling with 20 dB of electrical gain and 15 GHz of bandwidth. The Agilent 86100A Infiniium DCA has a wide range of bandwidths, low jitter, and the averaging and persistence features you need to make time-domain measurements.

The Agilent 86100A gives you a wide range of time-domain characterization capabilities including automated eye-diagram measurements, auto-aligning SONET/ SDH/Fibre Channel/ Gigabit Ethernet Masks and, repeatable extinction ratio measurements for eye diagram analysis.

# Specifications

**Specifications** describe the instrument's warranted performance over the 0 °C to 55 °C temperature range, except where noted. **Characteristics** provide information about non-warranted instrument performance in the form of nominal values. All amplitude specifications are in optical power units unless noted by an asterisk(*).

## Specifications/Characteristics

| | |
|---|---|
| **Wavelength** (characteristic) | *1200 nm to 1600 nm* |
| **Bandwidth** (characteristic) | *dc to 15 GHz (optical)*<br>*dc to 11 GHz (electrical)* |
| **Full Width Half Maximum** (calculated from FWHM = 0.44/BW opt) | 29.4 ps |
| **Conversion Gain** (dc responsivity)[1] (provided value accurate to ±20%) | > 200 V/W<br>300 V/W, nominal |
| **Noise Equivalent Power**[2] (characteristic) | *30 pW/$\sqrt{Hz}$* |
| **Input Return Loss** (characteristic with HMS-10/Diamond connector) | *> 23 dB* |
| **Aberrations** (characteristic) | *< 20% peak-to-peak* |
| **Corrected Freq Response**[3] dc – 22 GHz | 20 to 30°C 0 to 55°C<br>±2.2 dB* ±4.7 dB* |
| **Harmonic Distortion** Output < –10 dBm | > 41 dB* below fundamental |
| **Maximum Safe Optical Input Power** (average) | 10 mW (+10 dBm) |
| **Maximum Operating Optical Input Power** (peak) | 1.5 mW (+1.76 dBm) |
| **Output Voltage Range** (into 50 ohms) | > 700 mV |
| **Output Offset Voltage** (into 50 ohms) | < 1 mV |
| **Output Electrical Return Loss**<br>0.1 to 12 GHz (characteristic)<br>12 GHz to 22 GHz | <br>*> 11 dB**<br>> 9 dB* |

## Inputs/Outputs

| | |
|---|---|
| **Optical Input Connector** (front panel) | Single Mode Fiber Connectors: Diamond HMS 10, FC/PC, ST, DIN |
| **Output Connector** (front panel) | APC 3.5, male, 50 ohms (nominal) |

## General

| | |
|---|---|
| **Environmental** | |
| Temperature Range | Operational 0 to +55 °C<br>Storage –40 to +75 °C |
| EMI | Conducted and radiated emission are in compliance with the requirements of FTZ 1046; CISPR Publication 11 (1975); and MIL-STD-461C, Part 7, Methods CE03 and RE02. |
| **Power Requirements** | 100, 120, 220, or 240 volts (±10%), 47–63 Hz<br>Power consumption <75VA |
| **Weight** | 3.76 kg (8.4 lb) |
| **Dimensions** | 102 mm (4.02") height, 213 mm (8.39") width, 368 mm (14.49") length |

* Refers to electrical power units
1 ± Connector variation
2 = 3.7 µW in a 15 GHz bandwidth
3 Corrections are either downloaded into the Agilent 8593E, 8594E or 8595E spectrum analyzer or obtained from the calibration chart.

## Ordering Information

**Agilent 11982A** Amplified Lightwave Converter
(Must order one of the connector options listed below)
**Option 001** Frequency Response Correction/Menus (for use with Agilent 8593E/8594E/8595E spectrum analyzers only)

### Connector Options

**81000 AI** Diamond HMS-10 Connector Interface
**FC/PC-012** FC/PC Connector Interface
**81000 SI** DIN 47265 Connector Interface
**81000 VI** ST Connector Interface

### Recommended Accessories

**Agilent 11980A** Fiber-Optic Interferometer
**Agilent 11742A** Blocking Capacitor
**Agilent 5952-9654** Fiber-Optics Handbook
**Agilent 87441** Family of SDH/SONET/Fibre Channel Filters

**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 receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

**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 onsite 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.

## Agilent Email Updates

**www.agilent.com/find/emailupdates**

Get the latest information on the products and applications you select.

**Agilent T&M Software and Connectivity**

Agilent's Test and Measurement software and connectivity products, solutions and developer network allows you to take time out of connecting your instruments to your computer with tools based on PC standards, so you can focus on your tasks, not on your connections. Visit **www.agilent.com/find/connectivity** for more information.

**For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:**

**www.agilent.com/comms/lightwave**

**Phone or Fax**

**United States:**
(tel) 800 829 4444
(fax) 800 829 4433

**Canada:**
(tel) 877 894 4414
(fax) 800 746 4866

**China:**
(tel) 800 810 0189
(fax) 800 820 2816

**Europe:**
(tel) 31 20 547 2111

**Japan:**
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

**Korea:**
(tel) (080) 769 0800
(fax) (080)769 0900

**Latin America:**
(tel) (305) 269 7500

**Taiwan**:
(tel) 0800 047 866
(fax) 0800 286 331

**Other Asia Pacific Countries:**
(tel) (65) 6375 8100
(fax) (65) 6755 0042
Email: tm_ap@agilent.com

Contacts revised: 9/17/04

Product specifications and descriptions in this document subject to change without notice.


Printed in USA, September 21, 2004
5966-1583E

**Agilent Technologies**