

The HP 8509A/B Lightwave Polarization Analyzer

With the advent of the lightwave polarimeter, engineers in the fields of high-speed telecommunications, cable TV distribution, optical sensing, optical recording, and materials science can characterize polarization phenomena with the ease and graphical simplicity of the common oscilloscope. Supplemented by an optical source, a polarization state generator, and comprehensive measurement software, the polarimeter becomes a polarization analyzer, producing comprehensive measurements of both optical signals and two-port optical devices.

The HP 8509B lightwave polarization analyzer consists of an optical unit and a 66-MHz HP Vectra PC. The main display window, shown in Fig. 1, conveniently displays the polarization parameters of an optical signal and provides access to commonly used controls. The Measurements menu provides access to a variety of integrated measurement solutions addressing polarization-mode dispersion (PMD), polarization dependent loss, the Jones matrix, and optimization of optical launch into polarization maintaining fiber. The Display menu allows customization of the display window and the System menu enables the user to reconfigure system operating parameters, optimize performance at a particular wavelength, and automatically check the functional integrity of the instrument.

The heart of the HP 8509A/B is a high-speed polarimeter (see Fig. 4a in the accompanying article). A passive optical assembly (see cover) divides the optical signal into four beams and passes each beam through polarization filters to photodiode detectors. Autoranging amplifiers and 16-bit ADCs complete the circuitry. A series of calibration coefficients are determined at manufacture and stored in UV-PROM. The instrument interpolates among these coefficients to provide operation from 1200 to 1600 nm. Parallel filtering and detection combined with high-speed conversion and computation result in a measurement rate of 3000 polarization states per second.

A second optical assembly inserts three polarizing filters in the optical source path to allow measurement of the Jones matrix. The Jones matrix eigenanalysis PMD measurement method is based upon Jones matrixes (see page 28) measured at a series of wavelengths. Polarization dependent loss is also derived from the Jones matrix. In addition, the user can use external polarizers to define a physical reference frame, analytically removing the birefringence and polarization dependent loss of components between the polarizer and the polarimeter receiver. Once defined, the reference frame allows the measurement of absolute polarization state at a point far from the instrument itself.

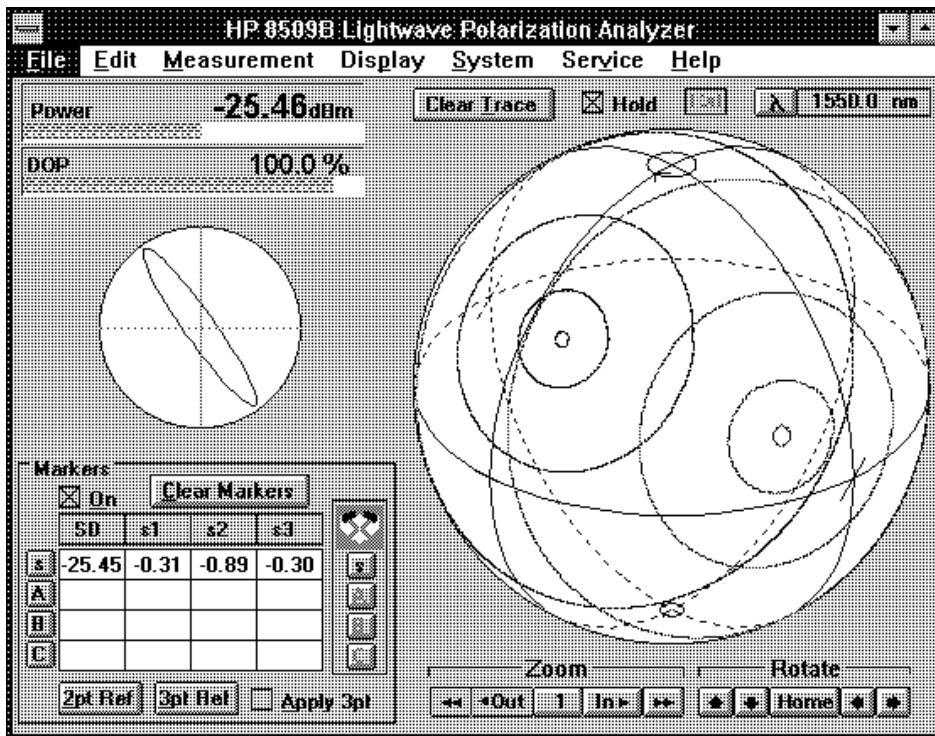


Fig. 1. Main measurement window of the HP 8509B lightwave polarization analyzer. Displays of average power and degree of polarization (DOP), along with elliptical and Poincaré sphere displays, fully characterize the polarization state of a lightwave. Shown on the sphere are the loci of output polarization states of a polarization maintaining fiber as the fiber is gently stretched. Red traces are on the front of the sphere, blue on the back. Different circles correspond to different states at the input of the fiber. The circles converge to points when polarized light is launched entirely on the fast or slow axes of the fiber.