Agilent N7786B Polarization Synthesizer

Data Sheet



Figure 1. N7786B Bench-top Instrument

Introduction

The Agilent N7786B contains a high-speed Lithium-Niobate based polarization controller and a polarization analyzer plus a microcontroller-based driving circuitry.

This unit can operate in various modes:

As a **polarization stabilizer**, it provides a stable output state of polarization (SOP) even with fluctuations and drifts of the input SOP. The stabilized output signal is guided in a standard single-mode fiber (SMF). The output SOP can be defined in the following ways:

- **Set-and-forget:** When the front button is pushed, the current SOP is stored and maintained, even if polarization changes occur on the instrument input.
- **Defined stokes**: The target output SOP can be defined by the user using the Stokes parameters.
- As a **synchronous scrambler**, the device switches the SOP of the output signal in a random (pseudo) way with a cycling speed of up to 100 KSOPs/s.

SOP switching occurs within a few microseconds. An electrical trigger input can be used to synchronize the scrambler with external events.

As an **SOP switch**, the N7786B cycles through a sequence of SOPs with a speed of more than 40 KHz, which corresponds to a cycle time of less than 25 microseconds. The sequence of SOPs can easily be defined by the user using Stokes coefficients.

As a traditional **scrambler**, the N7786B varies the output SOP in a random way.

Full coverage of the Poincaré Sphere is achieved within a few ms.

As a **polarization analyzer**, the instrument provides truly high-speed capabilities: More than 500K samples can be taken with a sample rate of up to 1 Megasample per second.

The unit does not contain any moving parts, and therefore is robust and withstands even rough environmental conditions.

All above-mentioned applications of the N7786B are supported by Agilent PC software that comes with this instrument.

Various instrument drivers and connectivity to external applications are provided through a DLL interface. Examples are included.

Key Benefits

- Comprehensive polarization stabilization/control
- Switching capabilities
- Reset-free/endless operation
- Covers entire range from 1.3 µm window up to the L-band
- Compact size
- Standalone operation
- Robust, no moving parts

Applications

- Transmission system test: polarization sensitivity analysis on link / transmission quality
- Recirculating loop experiments: loop-synchronous polarization scrambling
- Interferometry: polarization stabilization to maximize contrast ratio
- Polarization analysis

Agilent N7786B Instrument Setup and Application Examples

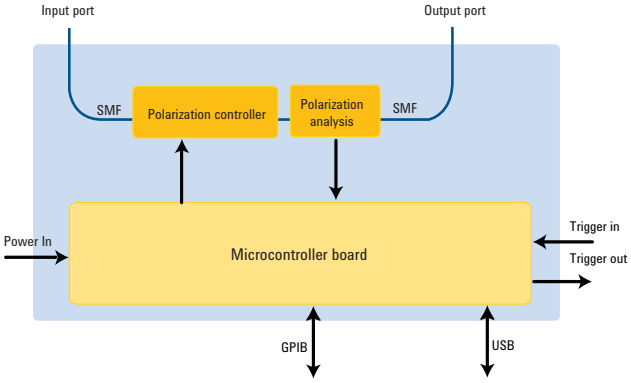


Figure 2. Instrument setup

The instrument setup is shown in Figure 2. A DSP-based electronics controls the polarization analyzer as well as the polarization controller. The SOP can be stabilized by means of a closed-loop operation of the DSP.

Application examples

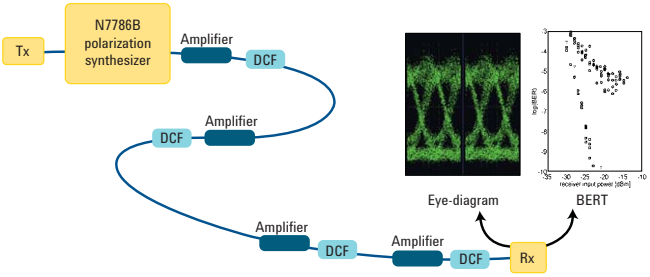


Figure 3. Transmission experiments

The transmission quality of links is known to depend on the state of polarization (SOP) of the launching signal. The N7786B is well suited to launch the modulated signal with predefined SOPs into the link. This allows probing for a range of SOPs on the Poincaré sphere to get information about particular polarization issues of a link.

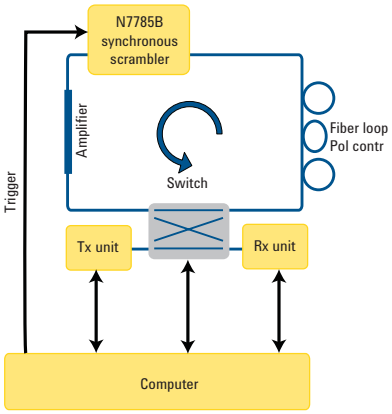


Figure 4. Recirculating loop

The results obtained in re-circulating loop experiments depend heavily on the PMD and PDL properties of the loop. Loop synchronous polarization scrambling schemes have proven to be necessary for generating results comparable to deployed systems. The N7786B is ideally suited to provide the synchronous scrambling capability in such experiments.

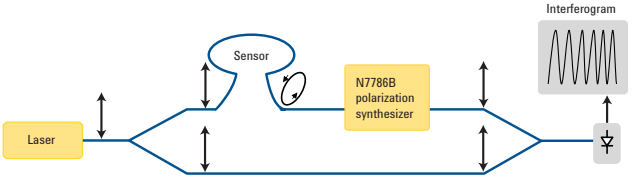


Figure 5. Interferometry/coherent detection

Fiber-optic-based interferometers or coherent receiver schemes need polarization stabilization in order to avoid fading problems of the interference signal. These fading effects are caused by orthogonally polarized fractions of the light. The N7786B allows elimination of such effects by alignment of the signal polarization.

Table 1: Specifications[1] N7786B Polarization Synthesizer

Wavelength	
Specification wavelength range	1270 nm ... 1375 nm, 1460 nm ... 1620 nm (Opt 400, O/C/L-Band) 1460 nm ... 1620 nm (Opt 500, C/L-Band)
Operating wavelength range[2)]	1260 nm ... 1640 nm
Polarization Control and Stabilization	
SOP switching time (non deterministic)	< 10 µs
SOP cycling time[6)]	< 25 µs
Remaining SOP error after deterministic SOP setting (typical)[7)]	< 3° at input SOP movement rate of 1.2 rad/s < 6.5° at input SOP movement rate of 40 rad/s
Polarization Analysis	
SOP uncertainty (typical)	1,5°
DOP uncertainty	± 2,0%
DOP uncertainty after user[3),5)] calibration (typical)	± 0,5%
Optical Power Measurement	
Relative power uncertainty[3)]	C/L-Band: ± 140 mdB (± 120 mdB typ.) O-Band: ± 160 mdB (± 140 mdB typ.)
Input power range	-38 dBm ... +19 dBm
Optical Power	
Insertion loss	< 4.0 dB (< 3.5 dB, typ)
PDL (typical)	< 0.2 dB
Maximum safe input power	20 dBm

1) Ambient temperature change max. ± 0.5°C since normalization. Specification valid on day of calibration.
2) SOP/DOP measurements are possible outside the specification wavelength range if the user performs a manual calibration.
3) Input power > -20 dBm.
4) DOP > 95%.
5) User calibration requires a source with a known DOP.
6) The instrument adaptively finds the polarization controller settings to let the SOP cycle through user-defined polarization states (closed loop operation). After having found these settings, the SOP can cycle through the polarization states in open loop operation.
7) This value is defined to be 5 times the standard deviation of the angular SOP error on the Poincaré sphere. Valid if controller is turned on. Power at instrument input > -10 dBm.

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