

## PRODUCT BRIEF

### KEY FEATURES

- ▶ Independent control of amplitude and phase for both polarizations
- ▶ Create Polarization Dependent Loss (PDL) shapes with high spectral resolution
- ▶ Create Differential Group Delay (DGD) curves
- ▶ PDL settable in range 0 to 20dB
- ▶ Create filters showing Polarization Dependent Frequency Shift (PDFS)
- ▶ 1 x 2 port configuration
- ▶ LCoS programmable array

### APPLICATIONS

- ▶ Communication Systems Test
- ▶ Stressing Polarization Multiplexed Systems
- ▶ Emulation of Polarization Dependent Frequency Shift (PDFS) of narrow band filters
- ▶ PDL Emulation
- ▶ DGD Emulation
- ▶ DWDM Channel Drop

### OVERVIEW

The WaveShaper 2000S Polarization Processor allows full control of amplitude and phase of both polarization components independently. Providing a difference in amplitude to both polarizations results in a Polarization Dependent Loss (PDL). A difference in phase of the two polarizations provides a Differential Group Delay (DGD).

The WaveShaper 2000S is ideally suited for systems test applications in which it stresses communication systems for various polarization effects. It can also operate polarization independently and serve with its 1 x 2 port configuration as a simple channel add/drop multiplexer.



WaveShaper 2000S Polarization Processor

### SETUP

The WaveShaper 2000S Polarization Processor is a Liquid Crystal on Silicon (LCoS) based optical processor. The optical signal entering the device is split in two polarization components. Both, the "horizontal" and the "vertical" polarization component create separate images on the LCoS array and can be controlled for amplitude and phase independently. Careful control of the parameters allows generation of wavelength dependent PDL or DGD or alternatively polarization independent operation when both components are being controlled symmetrically.

### SYSTEM TEST APPLICATIONS

The WaveShaper 2000S Polarization Processor can stress communication systems by creating frequency dependent PDL and DGD. As an example, figure 1 shows a frequency dependent PDL across the entire C-band. Different channels suffer from different levels of PDL. The insertion loss is kept constant over frequency in this example.

Figure 2 demonstrates intra-channel frequency dependent PDL. Such PDL can occur inside DWDM channels and is of concern in transparent networks where a large number of components get cascaded.

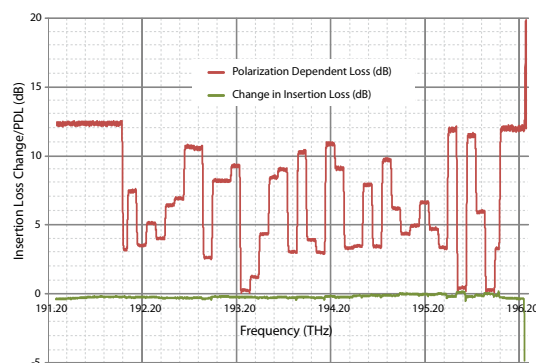


Figure 1

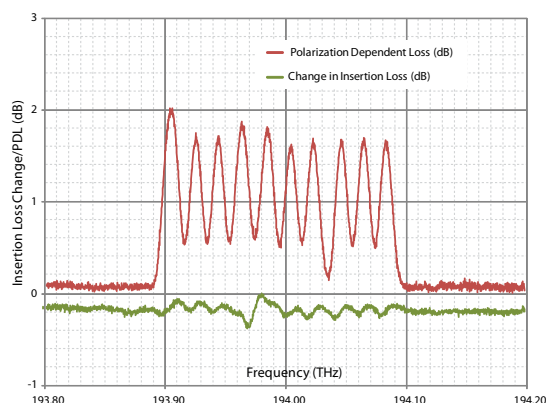


Figure 2

# WaveShaper 2000S Polarization Processor

Figure 3 shows a channel filter which suffers from Polarization Dependent Frequency Shift (PDFS). The transmission curves of the horizontal (H) and vertical (V) polarization component are shifted in frequency. As a result, a strong PDL develops on the filter slopes.

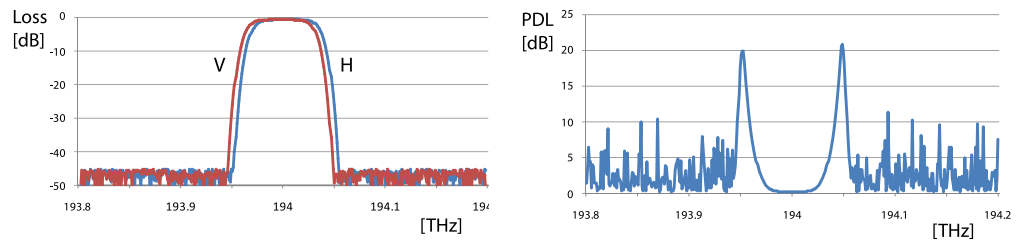


Figure 3

## PRELIMINARY SPECIFICATIONS

		Model 2000S
Loss and Dispersion (Note 1)	Operating Frequency Range	191.250 THz to 196.275 THz (1527.4 nm to 1567.5 nm)
	Insertion Loss (incl. connectors)	typ. 5 dB
	Insertion Loss Non-Uniformity	0.7 dB (typ. 0.5 dB)
	Polarization Dependent Loss (PDL)	0.7 dB (typ. 0.2 dB)
	Group Delay Ripple	< $\pm 0.75$ ps
	First-Order PMD (DGD)	< 0.5 ps (typ. < 0.25 ps)
	Chromatic Dispersion	< $\pm 10$ ps/nm
Filter Control (Note 1)	Filter Shape	Arbitrary
	Filter Bandwidth	10 GHz to 5 THz
	Center Frequency Setting Resolution	1 GHz (8 pm)
	Center Frequency Setting Accuracy	$\pm 2.5$ GHz
	Bandwidth Setting Resolution	1 GHz (8 pm)
	Bandwidth Setting Accuracy	$\pm 5$ GHz
	Bandwidth Setting Repeatability	$\pm 2.5$ GHz
	Group Delay Control Range	- 25 ps to + 25 ps
	Polarization Dependent Loss (PDL) Range	0 to 20 dB
	Differential Group Delay (DGD) Range	- 25 ps to + 25 ps
Attenuation Control	Settling Time	1000 ms
	Attenuation Control Range	0 - 20 dB
	Attenuation Setting Resolution	0.1 dB
Mechanical, Electrical and Environmental	Attenuation Setting Accuracy	$\pm 1.0$ dB from 0-10 dB, $\pm 10\%$ from 10-20 dB
	Maximum Total Input Optical Power	+ 27 dBm
	Maximum Per Channel Optical Power	+ 13 dBm
	Port Configuration	1 x 2, bidirectional
	Operating Temperature	15 °C to 35 °C
	Operating Humidity	10% to 85%
	Operating Voltage	100 V to 240 V
	Power Consumption	< 50 VA
	Communications Interface	USB 2.0
	Connector Type	FC/APC
	Size	241 x 88 x 316 mm <sup>3</sup>
	Weight	< 4 kg

Notes: 1. Measured over 60 GHz passband on a 100 GHz flat-top filter unless specified.

Part Number: WaveShaper 2000S WS-AA-2000S-ZZ-H

### Ordering Information:



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