Optical Instrumentation

WAVESHAPER® A-SERIES

1000A Programmable Optical Filter
4000A Programmable Optical Processor

Coverage of S-Band and U-Band

The WaveShaper 1000A and 4000A allow arbitrary optical filtering of attenuation and phase across the S-Band and the U-Band of optical communications. In addition, the 4000A allows wavelength selective optical switching and also programmable wavelength selective power splitting. This instrument family is broadly used in Research and Development applications.

FEATURES

- Product versions available for
  - S-Band
  - U-Band
- Arbitrary control of attenuation and phase
- Port configuration: 1 x 1 and 1 x 4 port
- Power splitting
- Webserver included

APPLICATIONS

- Wideband System Test
- Optical Comb Generation
- DWDM Testing
- Wavelength Selective Switching

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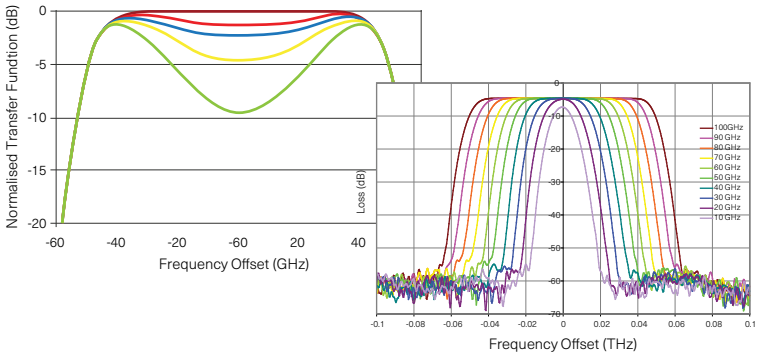
Applications

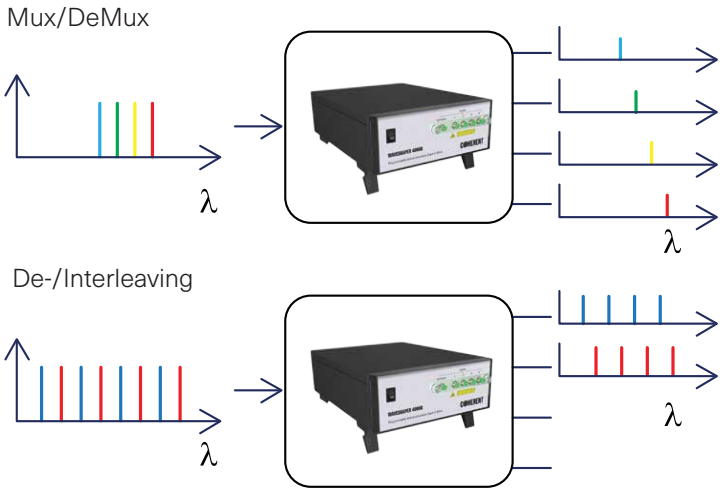
Filtering with arbitrary spectral shapes

Filtering with variable bandwidth and with arbitrary spectral shapes is of importance in system test experiments. For example, the influence of cascading of optical filters on the transmission quality can be investigated by programming the resulting filter shape into the WaveShaper.



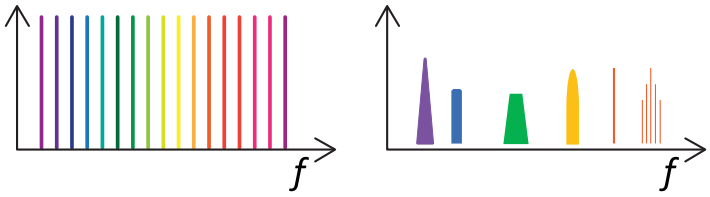
Mux/DeMux and De-/Interleaving

The WaveShaper 4000A can serve as a programmable Multiplexer/Demultiplexer or Interleaver/De-Interleaver. It can incorporate basically any channel spacing, including non-equally spaced channels. It fully supports Flexgrid™, the standard approach to flexible grid network architectures. Since it can operate in both directions, it can be used as a wavelength splitter as well as a combiner.



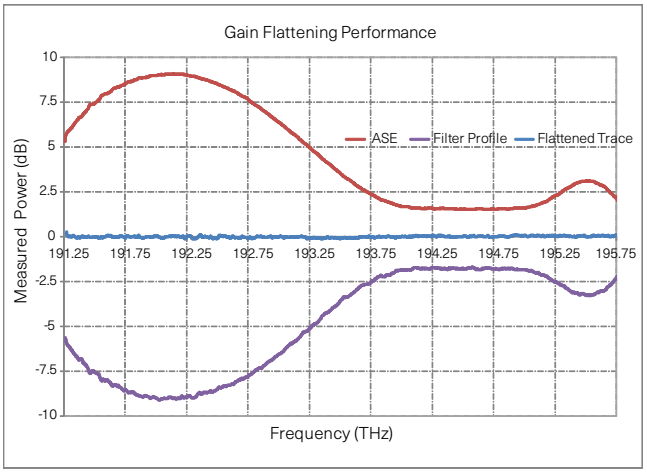
Component and System Loading

Generation of controllable optical combs is key in a variety of module and system test applications. For example, loading an amplifier with a representative power spectrum is required for proper amplifier testing. Similar requirements exist for testing optical systems involving amplified links. The WaveShaper can create individual spectral lines – even with shapes as if they were modulated.



Gain Equalization

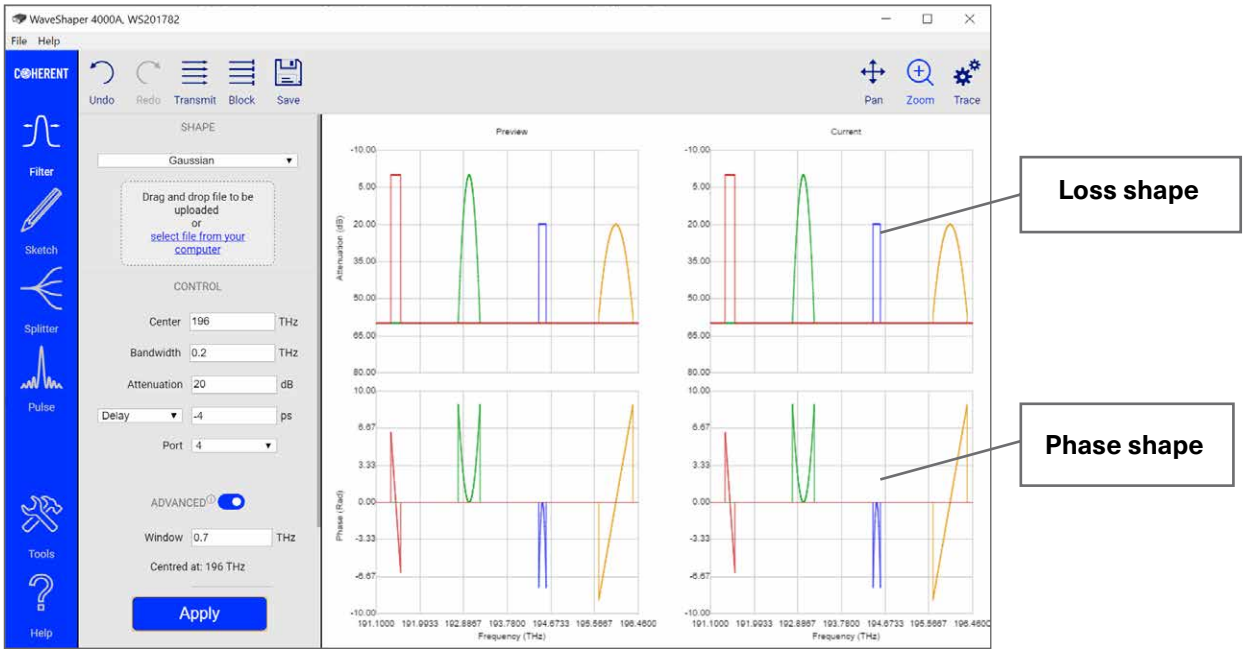
A number of parameters need to be verified in communication test beds including the tolerance of the transmission system to spectral shapes of the gain. The WaveShaper allows creating such gain shapes with very high resolution (down to 0.01 dB attenuation steps), which allows for creation and compensation of such gain shapes.



Graphical User Interface (GUI)

The WaveShaper A Series instruments are controlled from an external device to select and update the filter shape. Communication with the WaveShaper is via USB or Ethernet interfaces. For the Graphical User Interface (GUI), the A Series WaveShaper supports the following approaches:

- **Integrated Webserver (Ethernet Interface):** The WaveShaper Series A instruments contain an in-built webserver that provides the most flexible approach, as the users client only needs to provide a web browser. No dedicated software or drivers are required. Supported systems include Windows 7 and higher, Linux, OS X, Android, iOS etc. Existing *.wsp and *.ucf files can be used, providing backward compatibility with current filter profiles.
- **WaveShaper App software package (Ethernet Interface):** This package runs on the user's computer and is available for Win 11 systems. It provides the same functionset as operation through the web browser, as well as providing a full device discovery service for networked units.
- **WaveManager 2.7x software package (USB Interface):** WaveShaper A Series instruments are fully backward-compatible with the existing WaveManager 2.7x software. This package runs on the user's computer and is available for Win 7, Win 8.1 and Win 10 systems. It provides the same functionset as operation through the web browser plus it has additional functions supporting power splitting and modeling (which provides a prediction of the real filter curve considering physical limitations). The WaveManager 2.7x software package can be downloaded from https://www.coherent.com/networking/optical-instrumentation



Application Programming Interface (API)

The WaveShaper A Series instruments include a web service API which enables the user to remotely configure the device over an Ethernet connection using HTTP commands from any software programming language. Programming examples are available for LabView, Matlab, Python, Octave, Visual Basic and C#.

WaveShaper Demonstration on YouTube

Watch product demo at: https://www.youtube.com/@CoherentCorp

WaveShaper Specifications

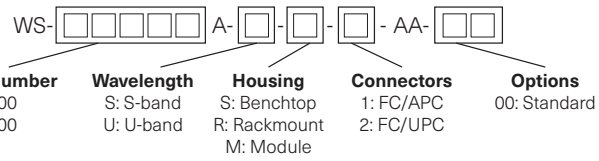
Model		1000A/S, 4000A/S	1000A/U (3), 4000A/U (3)
Wavelength Band		S-Band	U-Band
Optical Ports	Port Configurations	1x1, 1x4	
Filter Control	Operating Frequency Range	196.2 THz to 204.2 THz (1468.0 nm to 1528.0 nm)	181.55 THz to 190.25 THz (1575.8 nm to 1651.3 nm)
	Filter Bandwidth	20 GHz - full range (0.16 nm - full range)	
	Filter Shape	Arbitrary	
	Frequency Setting Resolution	±1 GHz (±8 pm)	
	Frequency Setting Accuracy	± 5 GHz	
	Bandwidth Setting Resolution	±1 GHz (±8 pm)	
	Bandwidth Setting Accuracy	± 10 GHz	
	Bandwidth Setting Repeatability	± 5 GHz	
	Group Delay Control Range	-15 ps to +15 ps	
	Attenuation Control Range	0 to 35 dB	
	Attenuation Setting Resolution	0.01 dB	
	Attenuation Setting Accuracy	±1.0 dB from 0 to 10 dB, ±10 % from 10 to 30 dB	
	Settling Time	<500 ms	
Loss and Dispersion	Insertion Loss	< 7 dB (1)	
	Insertion Loss Non-Uniformity	1 dB	
	Polarization Dependent Loss (PDL)	0.8 dB	
	Differential Group Delay (DGD)	< 0.5 ps	
	Return Loss	>25 dB	
Optical Power (2)	Max Total Input Optical Power	+27 dBm	
	Max Optical Power per 50 GHz channel	+13 dBm	
Environment	Operating Temperature	Bench-top / Rack-mount instrument: 15 to 35°C Module: 15 to 55°C with airflow of min 1 m / sec across top of module	
	Operating Humidity	10 to 90%	
Electrical	Communications Interface	Ethernet (GbE), USB 2.0	
	Power Consumption	<50 VA	
Mechanical	Connector Interface	FC/APC	
	Dimensions, weight	Bench-top: 241 mm x 88 mm x 316 mm, 3.8 kg Module: 220 mm x 140 mm x 37 mm, 0.8 kg	

Notes
(1) Valid for Filter Bandwidth settings of 25 GHz and larger. For Filter Bandwidth settings below 25 GHz an additional loss of up to 2 dB may apply.
(2) Optical signals with spectral components below 600 nm must be avoided.
(3) Optical specifications are guaranteed up to 1649 nm. Above 1649 nm Specifications are met on a best effort basis.

Configuration Guide

Model	Order Code	Description	Wavelength band	Housing option	Fiber Type	Connector type
WaveShaper 1000	WS-01000A-S-S-1-AA-00	Programmable Optical Filter	S	Benchtop	SM	FC/APC
	WS-01000A-U-S-1-AA-00	Programmable Optical Filter	U	Benchtop	SM	FC/APC
WaveShaper 4000	WS-04000A-S-S-1-AA-00	Programmable Optical Processor	S	Benchtop	SM	FC/APC
	WS-04000A-U-S-1-AA-00	Programmable Optical Processor	U	Benchtop	SM	FC/APC

Order Code Key



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