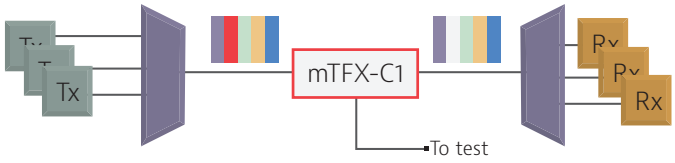
MAP-200 Multiport Tunable Filter Module, MTFX-C1

The Multiple Application Platform (MAP-200) multiport tunable filter module (mTFX-C1) dramatically simplifies test signal management for next-generation 100 G+ interfaces, sub-systems, and system test.

Get the right wavelengths to the right test port with the right power—quickly. Flexibly isolate, groom, manage, and route any wavelength or group of wavelengths with a simple, intuitive GUI and/or SCPI-based remote commands. The mTFX-C1 is a modular Ethernet or GPIB instrument and can be directly managed from your PC-based automation system. It eliminates the need to re-purpose optical network technology or use complex libraries with specialized interface cards.



Drop and groom channel with ideal or stressed filter shape

Figure 1. Example application: isolate (drop) a signal from a DWDM test system and route to a test application while expressing all other wavelengths to other receivers

Based on next-generation liquid crystal on silicon (LCOS) technology, the mTFX-C1 is much more than a tunable filter. It combines variable attenuator, switch, power meter, and DWDM multiplexer functions to dramatically simplify photonic testing of coherent interfaces, amplifier, and DWDM systems. Leveraging TrueFlex™ technology, filters are continuously tunable in center wavelength and bandwidth and are not locked to the ITU grid. Multiple parallel wavelength paths can be created without disrupting already established connections—all with sub-GHz resolution. Industry-leading specifications for loss and out-of-band rejection ensure minimal impairments on your test signals.

Key Features and Benefits

- Tunable filter with bandwidth adjustment from 16 to 5100 GHz with 0.5 GHz resolution
- Low loss (<5.5 dB), continuous extended C-band coverage with ±3.5 GHz wavelength accuracy
- Up to 80 independent filters, each with independent attenuation and output port assignment
- New filters can be added and removed without disturbing existing connections
- Internal power meter option with automated single and multiple peak find algorithms
- Automated peak tracking function without loss of transmitted power
- Fast, simple GUI and SCPI control interfaces for filter generation
- Optional SW license to enable up to 8 output ports

Applications

- Photonic communication test automation
- 100 G+ coherent interface testing
- ROADM node emulation
- Signal extraction or insertion during DWDM system testing
- Amplifier gain spectrum management and load tone generation

Compliance

CE, CSA/UL/IEC61010-1, and LXI Class C requirements (when installed in a MAP chassis)

Light Direct

As part of the broader LightDirect family of MAP-200 modules, the mTFX-C1 can be deployed in the compact MAP-220C 2-slot chassis or the larger 3- and 8-slot rack-mount chassis systems (MAP-230B or MAP-280). Alongside the many other modules, such as amplifiers, precision attenuators, power meters, and spectrum analyzers, the MAP-200 is the ideal, modular photonics test platform for 100 G+ test applications.

Figure 2. MAP-200 LightDirect family of modules

Simplified Interface and Control

To simplify interaction and programming, control of the mTFX-C1 has been divided into simple, easy-to-visualize functional blocks. A "virtual filter" is defined by a center wavelength, bandwidth, shape, and attenuation. A virtual filter can be easily moved anywhere in the C-band through assignment of the center wavelength. The virtual switch allows the filter to be expressed to a physical output port. Up to 80 virtual filters can be created and independently controlled. To manage assignment conflicts, a slice of spectrum may only be assigned to one output port at a time (although multiple independent slices can go to the same port).

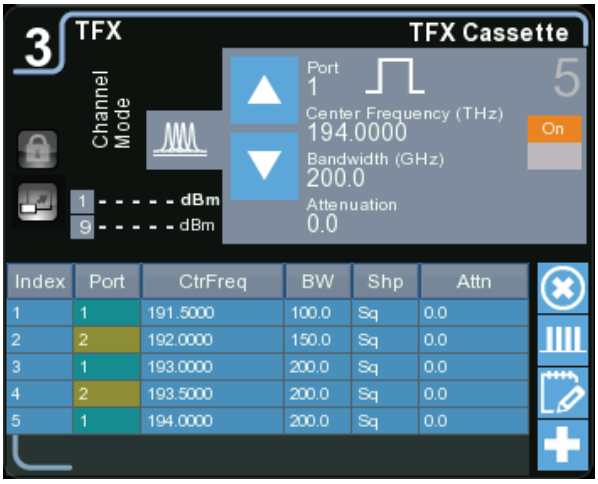


Figure 3. The MAP-220 GUI

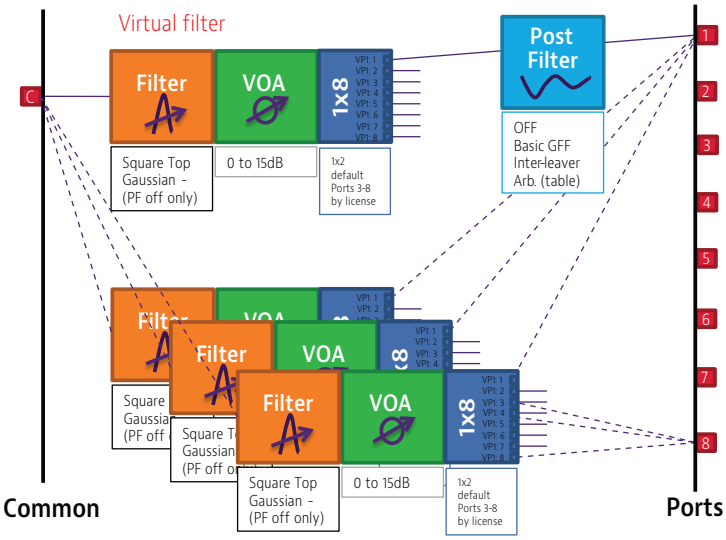


Figure 4. The MTFX-C1 showing individual control blocks

Modes

Three control modes are available to further simplify use and let a user tailor the level of complexity they require.

Channel Mode

Channel mode is the basic operation mode. In this mode, the post-filter has been disabled. This allows for powerful yet simple control of individual virtual filters. This mode supports both square- and Gaussian-shaped filters. Square top modes are ideal for ROADM emulation and systems employing multiple carriers in the channel. Gaussian shapes are ideal where it is critical to have the filter center wavelength and the carrier tightly aligned. Any drift in the carrier results in an unambiguous decrease in the power of the signal.

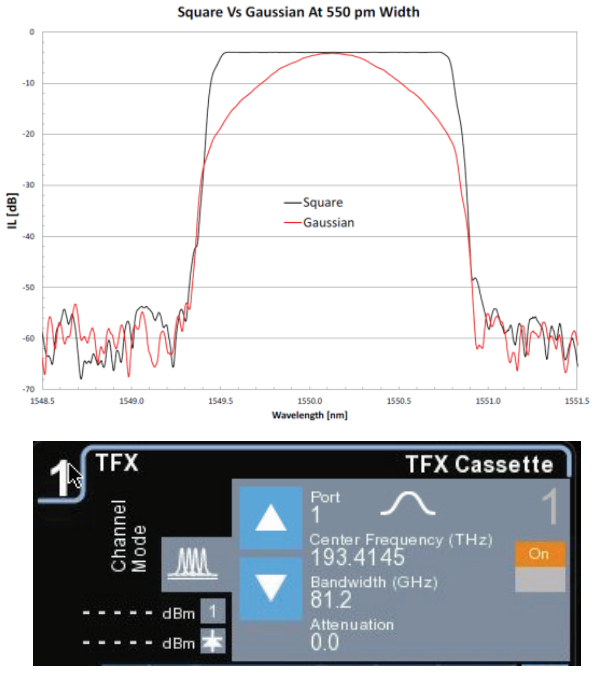


Figure 5. Channel-mode GUI control and the resulting filter shape

Channel mode also includes an automated express capability. In a single command, the unfiltered spectrum is automatically routed to the selected port.

If the internal power meter option is selected, three powerful peak-signal detection functions become available.

- Peak Find — find and report the center wavelength of all signals in the search range above a threshold; the signal is blocked while executing
- Peak Search — find the maximum power in the range AND establish an isolation filter around it
- Peak Up — optimize the placement of an isolation filter around a signal to maximize the transmitted power

Full Mode

Full mode disables the virtual filters and allows the unit to be operated like a simple single-port programmable filter. The primary intention of this mode is to shape the full transmitted spectrum and it is an ideal tool to generate frequency combs, gain tilt, and gain shape corrections. Standard programmable shapes are available and users may upload up to five custom shapes.

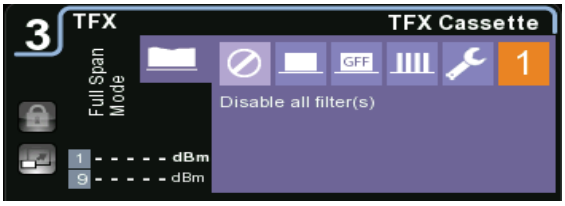


Figure 6. Full mode control

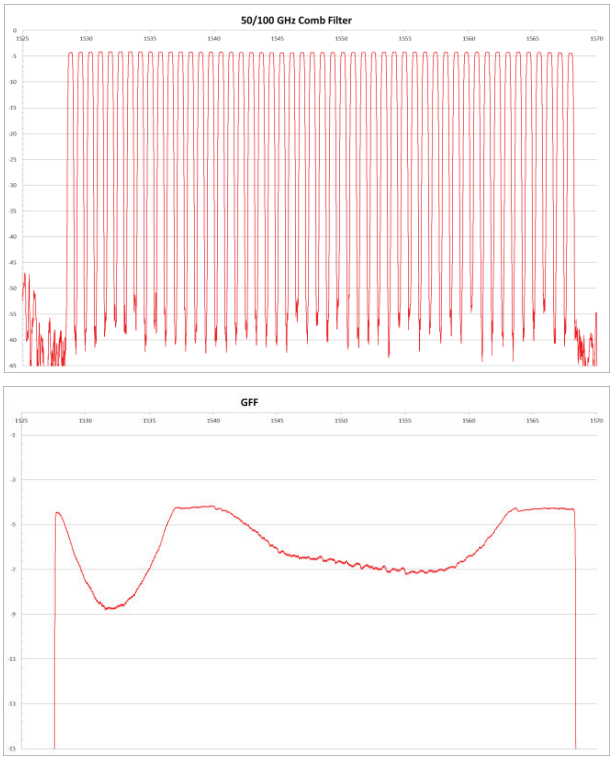


Figure 7. Examples of full span shapes: a comb filter (top) and gain flattening filter (bottom)

Shape Mode

Shape mode combines the power of Channel and Full mode. Together, they enable the generation of more complex filtering patterns while retaining a simple and intuitive interface. In this mode, the virtual filter attenuation profile is modified by the presence of the Full mode attenuation shape.

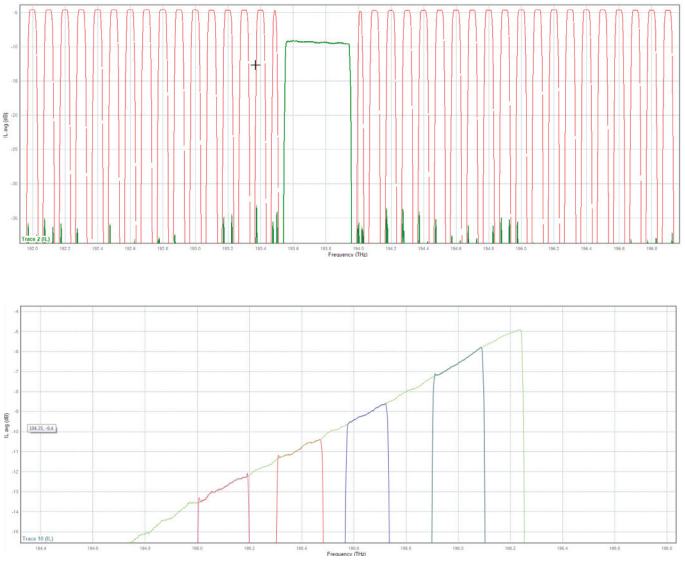


Figure 8. In the upper example, the comb pattern is interrupted to insert a test signal in the spectrum allocated by the green filter trace; the lower plot shows a single tunable filter being modified by the green slope filter (the slope filter shown is from a memory trace)

Specifications

Parameter	Value
Frequency range	191.15 to 196.25 THz 1527.61 to 1568.35 nm
Number of output ports	2 4 or 8 available with additional licenses
Max number independent user-defined filters	80
Standard filter shapes	Square top Gaussian top (valid for first 20 dB)
Insertion loss[1]	
Port 1 standard configuration Port 1 with power monitor option Ports 2 to 8	<5.5 dB <6.0 dB <6.0 dB
Short-term insertion loss stability[2]	
Averaging time <10 ms	±0.05 dB
Averaging time >10 ms	±0.01 dB
Insertion loss repeatability[3]	±0.025 dB
PDL[4]	<0.3 dB 0 to 10 dB attenuation (typical)
Return loss[5]	>30 dB
Square top filter bandwidth[6]	16 to 5100 GHz
Maximum bandwidth for Gaussian filter shape	250 GHz
Center wavelength and bandwidth resolution	0.5 GHz
Center frequency accuracy[7]	±3.5 GHz (typical) ±5 GHz (max)
Maximum input power	
For single 12.5 GHZ channel	13 dBm
Broadband source	24 dBm
Max attenuation range	
Gaussian profile	10 dB
Square top profile	20 dB
Attenuation setting resolution	0.1 dB
Single filter, average out of band rejection[8]	>40 dB
Group delay variation	
Gaussian top, over 3 dB bandwidth	<5.0 ps
Square top, over 80% of bandwidth	<4.0 ps

Parameter	Value
Differential group delay	
Gaussian top, over 3 dB bandwidth	<2.0 ps
Square top, over 80% of bandwidth	<0.3 ps
Warm-up time	60 min
Operating temperature	0 to 45°C
Storage temperature	-30 to 60°C
Dimensions	8.1 x 13.26 x 37.03 cm
Weight	2.54 kg (5.4 lb)

1. Includes 1 optical connector. Measured using depolarized light source. For filters with bandwidth >20 GHz.
2. Measured using a depolarized light source. Values at center wavelength with no attenuation applied. Values reported are 3σ measured over 20,000 samples at the indicated averaging time.
3. Min-max, Insertion Loss variation measured using depolarized source at the center wavelength. Measured by activating and deactivating filter at the same wavelength on the same output port.
4. PDL is valid at the Gaussian minimum loss or over 80% of square top bandwidth.
5. Excludes directivity. Measured into a common port when all other channels are routed to outputs.
6. Bandwidth is specified at 0.2dB loss level relative to the minimum filter insertion loss. Allocated spectrum based on square top filter definition. Selection of Gaussian profile will reduce the effective bandwidth of the channel.
7. Center wavelengths is measured at 3 dB and 10 dB levels relative to minimum loss in the filter.
8. Ratio of filter minimum IL to background maximum from a spectrum ranges that would represent a higher and lower frequency adjacent channel.

Ordering Information

Description	Part Number
Base Configurations	
Multiport tunable filter, 2 ports	mTFX-C111C008C0
Multiport tunable filter with embedded power monitor, 2 ports	mTFX-C11C008CM
Required Options	
Single-mode fiber	M100
FC/PC bulkhead connectors	MFP
FC/APC bulkhead connectors	MFA
SC/PC bulkhead connectors	MSC
SC/APC bulkhead connectors	MSU
Orderable Options	
Software key to enable 2 additional ports (total of 4)	mTFX4PORT
Software key to enable 6 additional ports (total of 8)	mTFX8PORT

Contact Us **+1 844 GO VIAVI**
(+1 844 468 4284)

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mtfx-ds-lab-tm-ae
30179613 000 0116