Signal Filtering in the CSA OMM-202

Overview

This application note describes the analog signal filtering in the OMM-202 Precision Measurement Module.

Summary

Analog filtering removes noise from a signal. Since many optical signals have noise on the signal, analog filtering is a useful function. Typical noise on an optical signal results from:

- power line noise from the Tunable Laser Source, typically 50 or 60 Hz, with harmonics
- digital noise from the Tunable Laser Source, typically 10 KHz and higher
- vibrational noise in the optical path, typically 1-10 Hz, 60 Hz, and 200 Hz – 1 KHz
- etalon induced noise in the optical path, which varies with the FSR of the etalon

As a result, all optical measurement devices employ built-in filtering of some kind. In the CSA there is both a normal filter and a selectable additional filter.

Note: This does not include the additional digital filtering capabilities of the CSA.

Filter Bandwidths

The filter bandwidths of the various ranges and filter configurations are shown in the table below. Note that these are for the standard OMM 202. There is a special version that has higher bandwidth (contact the factory for information).

Range	Bandwidth- Filter Off	Bandwidth- Filter On
Fast 10 dBm	7.5 KHz	2.5 KHz
Fast -10 dBm	7.5 KHz	2.5 KHz
Fast -30 dBm	400 Hz	400 Hz
Fast -50 dBm	4 Hz	4 Hz
Fast -70 dBm	1 Hz	1 Hz

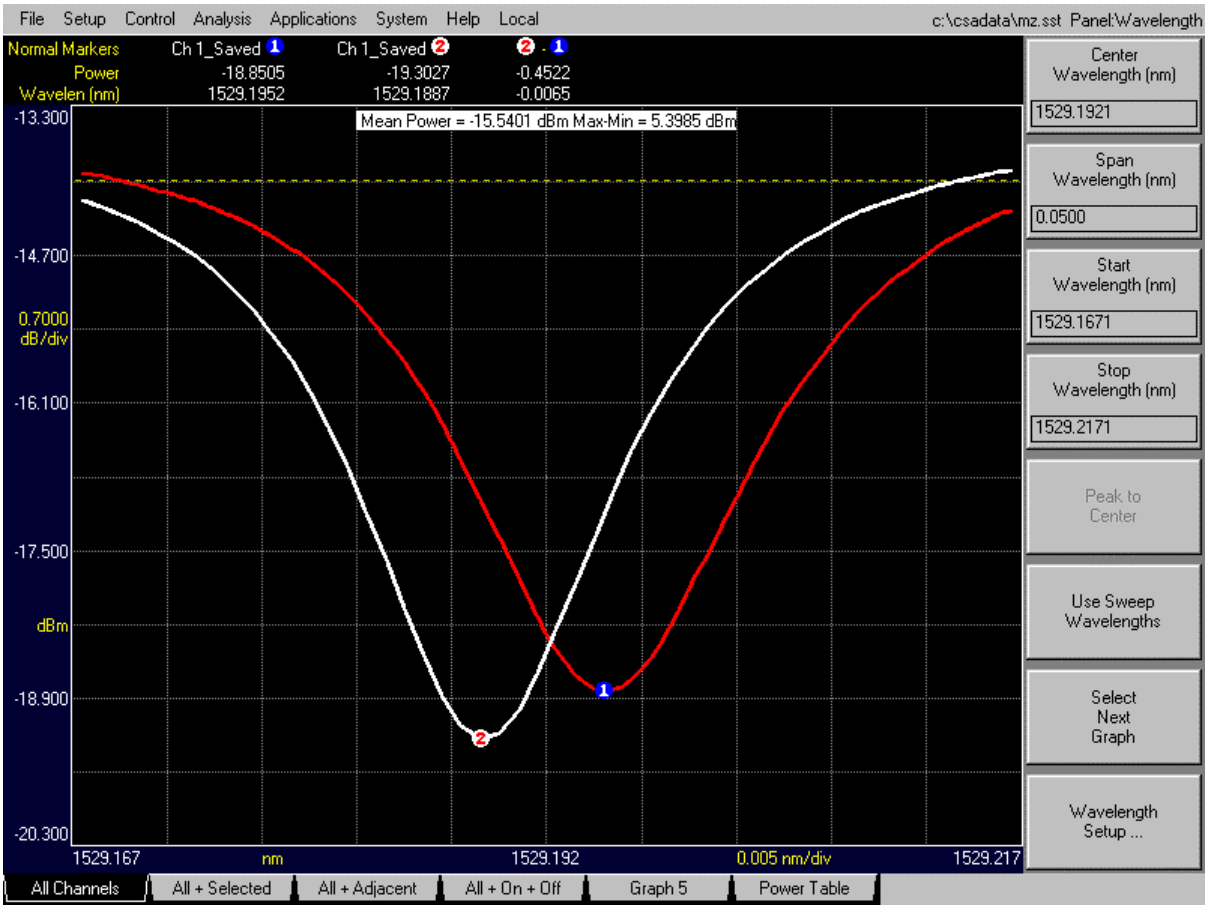
Filter Delay

Filters also impose a delay on transitions of the signal. The approximate delays are shown below with the implied wavelength delay at different TLS sweep rates.

Range	Delay (sec)	Delay (? at 5 nm/sec)	Delay (? at 10 nm/sec)	Delay (? at 40 nm/sec)	Delay (? at 80 nm/sec)	Delay (? at 100 nm/sec)
Fast 10 dBm	0	0	0	0	0	0
Fast 10 dBm FILT On	155 µsec	0.75 pm	1.5 pm	6.2 pm	12.4 pm	15.5 pm
Fast -10 dBm	0	0	0	0	0	0
Fast -10 dBm FILT On	155 µsec	0.75 pm	1.5 pm	6.2 pm	12.4 pm	15.5 pm
Fast -30 dBm	425 µsec	4.8 pm	8.5 pm	17 pm	34 pm	42.5 pm
Fast -50 dBm	425 µsec	4.8 pm	8.5 pm	17 pm	34 pm	42.5 pm
Fast -70 dBm	*	*	*	*	*	*

Example

The following CSA screen print shows an example of the filter delay using a sweep at 40 nm/sec on a dBm Optics WA-1525-C Acetylene Wavelength Reference Cell.



Settling Time

Filters have a settling time. Specifying settling time depends on the degree of settling that is desired. The table below shows the settling time for the different ranges, for different levels of settling. OMM-202 and OMM-201 are designed to ensure that full scale signal at the filter frequency are not slew rate limited.

			Settling time (sec) to full accuracy Change in Signal (in dB and % of range)				
			66dB	.4dB	0.04dB	.004dB	.0004dB
Range	Filter Setting	Freq	100%	10%	1%	0.10%	0.01%
10dB	Off	7500	0.000199	0.00015	0.00010	0.00005	0.000004
10dB	On: 2.5KHz	2500	0.000598	0.00045	0.00031	0.00016	0.000013
-10dB	Off	7500	0.000199	0.00015	0.00010	0.00005	0.000004
-10dB	On: 2.5KHz	2500	0.000598	0.00045	0.00031	0.00016	0.000013
-30dB	na	400	0.003740	0.00283	0.00191	0.00099	0.000080
-50dB	na	4	0.374025	0.28251	0.19099	0.09947	0.007958
-70dB	na	1	1.496101	1.13003	0.76397	0.39790	0.031832
Time Constants			9.4	7.1	4.8	2.5	0.2

Notes:

(1) All filter specifications are typical, and may vary slightly from unit to unit.
(2) Bandwidth: The frequency (Hz) at which the signal amplitude drops by 1/2 (3dB).

dBm Optics, Inc.
300 South Public Road
Lafayette, CO 80026
303-464-1919
www.dbmoptics.com