

# MEMS TUNABLE OPTICAL FILTER

## OVERVIEW

**Sercalo's** Tunable Optical Filter is based on MEMS technology and is designed for ITU O, C and L band with 50 GHz or 100 GHz channel spacing. The highly reliable tuning mechanism uses an integrated micro-mirror with switching time below 50 ms and insertion loss below 3 dB. The bare Tunable Filter component (BCTF variant) measures only 43 x 11 x 9.5 mm<sup>3</sup> and is ideal for applications requiring reduced size and weight. The miniature package withstands rugged environments and is well suited for direct mounting on printed circuit boards. An interface board with UART and I<sup>2</sup>C/SMBus is also available. The component is compliant to Telcordia 1221 reliability standards and ROHS requirements 2011/65/EU.

## FEATURES

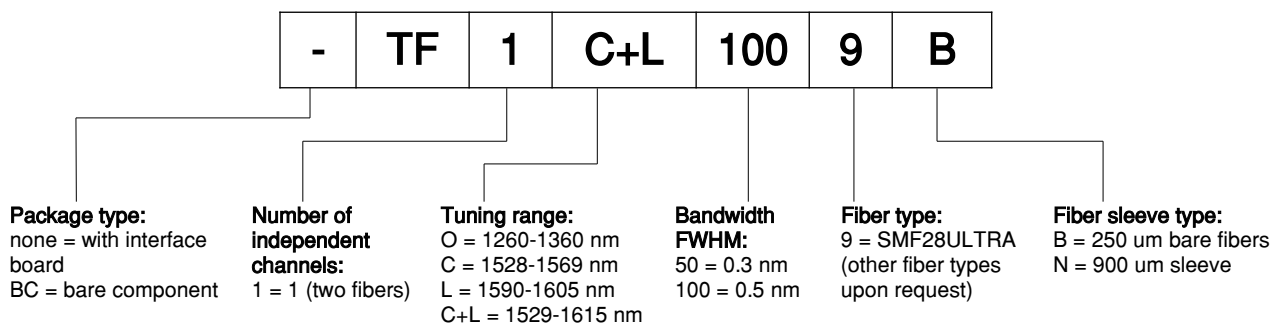
- Small 43 x 11 x 9.5 mm<sup>3</sup> body size
- Low insertion loss
- Also available with UART and I<sup>2</sup>C/SMBus interface board

## APPLICATIONS

- Reconfigurable optical add/drop multiplexers
- Optical sensor interrogators
- Optical power monitors
- Low cost spectrometers

**Contact:**  
**Sercalo Microtechnology Ltd.**  
 Landstrasse 151  
 9494 Schaan - Principality of Liechtenstein  
 Tel. +423 237 57 97 Fax. +423 237 57 48  
<http://www.sercalo.com> e-mail: [info@sercalo.com](mailto:info@sercalo.com)

## ORDERING INFORMATION



## DESCRIPTION

**Sercalo's** Tunable Filter is composed by an optical system where light coming from the input fiber is collimated on a fused silica grating. The grating diffracts the light with a distinct angle for each wavelength. Light is then reflected by a MEMS mirror onto the output collimator which only couples a small fraction of it into the output fiber. By modifying the MEMS mirror tilt angle user can chose the central wavelength of the filter.

## TECHNICAL SPECIFICATIONS

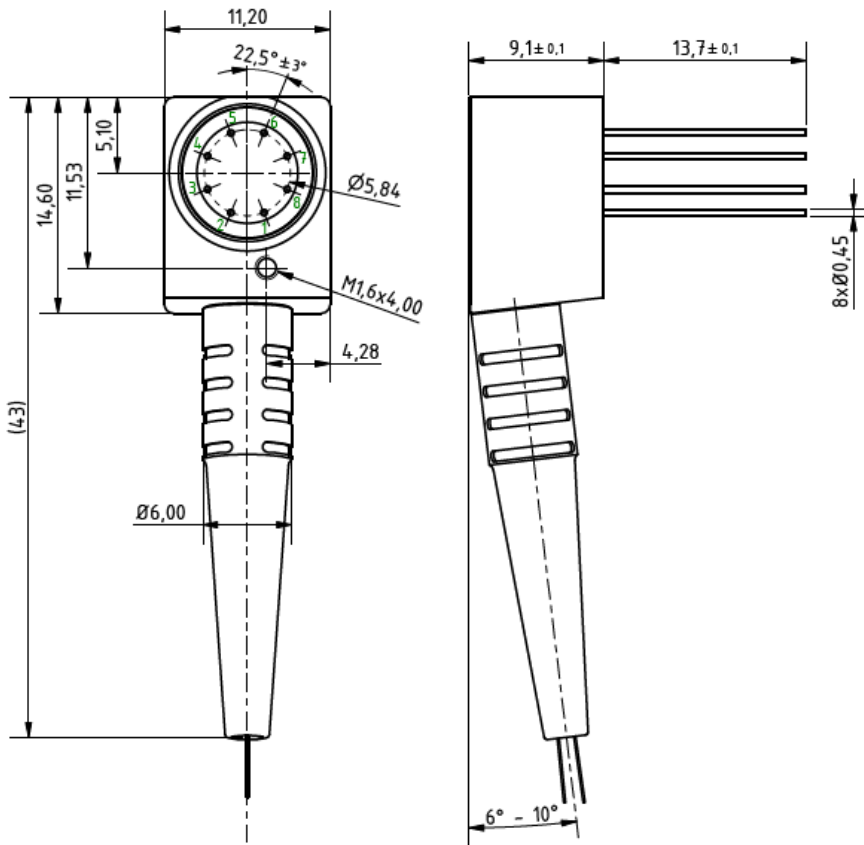
|  | <i>Unit</i>             | <i>Min</i>                 | <i>Typ</i> | <i>Max</i> |
|--|-------------------------|----------------------------|------------|------------|
| <b>Optical specifications</b>                        |                         |                            |            |            |
| Tuning range (O band variant)                        | nm                      | 1260                       |            | 1360       |
| Tuning range (C band variant)                        | nm                      | 1528                       |            | 1569       |
| Tuning range (L band variant)                        | nm                      | 1570                       |            | 1615       |
| Tuning range (C+L band variant)                      | nm                      | 1529                       |            | 1615       |
| Insertion loss <sup>1</sup>                          | dB                      |                            | 2.5        | 4.0        |
| Variant<br>TFxx50                                    | Full bandwidth @ 0.5 dB | nm                         | 0.12       |            |
|  | Full bandwidth @ 3 dB   | nm                         | 0.3        |            |
|  | Full bandwidth @ 10 dB  | nm                         | 0.6        |            |
|  | Full bandwidth @ 20 dB  | nm                         | 0.8        |            |
| Variant<br>TFxx100                                   | Full bandwidth @ 0.5 dB | nm                         | 0.2        |            |
|  | Full bandwidth @ 3 dB   | nm                         | 0.5        |            |
|  | Full bandwidth @ 10 dB  | nm                         | 1.0        |            |
|  | Full bandwidth @ 20 dB  | nm                         | 1.2        |            |
| Return loss  | dB                      | 30                         |            |            |
| Wavelength repeatability                             | nm                      |                            | 0.01       |            |
| Wavelength temperature dependence                    | pm/°C                   |                            | 1          | 5          |
| Switching time                                       | ms                      |                            | 10         | 50         |
| PDL  | dB                      |                            | 0.3        |            |
| Durability   | cycles                  | No wear out                |            |            |
| Side Mode Suppression Ratio (SMSR)                   | dB                      | 25                         |            |            |
| <b>Electrical specifications (optical component)</b> |                         |                            |            |            |
| Driving voltage                                      | V                       | 0                          |            | 60         |
| Driving voltage damage threshold                     | V                       |                            |            | 65         |
| Electrostatic discharge tolerance <sup>2</sup>       | V                       |                            |            | 70         |
| <b>Electrical specifications (control board)</b>     |                         |                            |            |            |
| Supply voltage                                       | V                       | 4.75                       | 5          | 5.25       |
| Power consumption (idle)                             | W                       |                            | 0.2        |            |
| Power consumption (operating)                        | W                       |                            | 1          |            |
| UART speed   | baud                    | 9600                       |            | 115200     |
| SMBus/I <sup>2</sup> C bus speed                     | kHz                     |                            |            | 400        |
| Input logic level low                                | V                       |                            | 0          | 0.6        |
| Input logic level high                               | V                       | 2.4                        | 5          |            |
| Output logic level low                               | V                       |                            | 0          | 0.6        |
| Output logic level high                              | V                       | 2.6                        | 3.3        |            |
| Reset inactive voltage <sup>3</sup>                  | V                       | 2.4                        | 5          |            |
| Reset active voltage                                 | V                       |                            | 0          | 0.9        |
| Reset pulse duration                                 | µs                      | 15                         |            |            |
| <b>Package</b>                                       |                         |                            |            |            |
| Operating temperature                                | °C                      | 0                          |            | 70         |
| Storage temperature                                  | °C                      | -40                        |            | 70         |
| Operation humidity (non condensing)                  | % r.h.                  | 0                          |            | 95         |
| Pigtail length                                       | cm                      | 50                         |            | 100        |
| Size (optical component)                             | mm                      | 43.3 x 11.2 x 9.5          |            |            |
| Size (with control board)                            | mm                      | 45 x 23 x 10               |            |            |
| Weight   | g                       | 75                         |            |            |
| ROHS Compliance                                      |                         | 2011/65/EU (no exceptions) |            |            |

<sup>1</sup>Value @ 25 °C, without connectors. <sup>2</sup>The bare optical component is not protected against ESD and need special care during handling.

<sup>3</sup> Through onboard pull-up resistor.

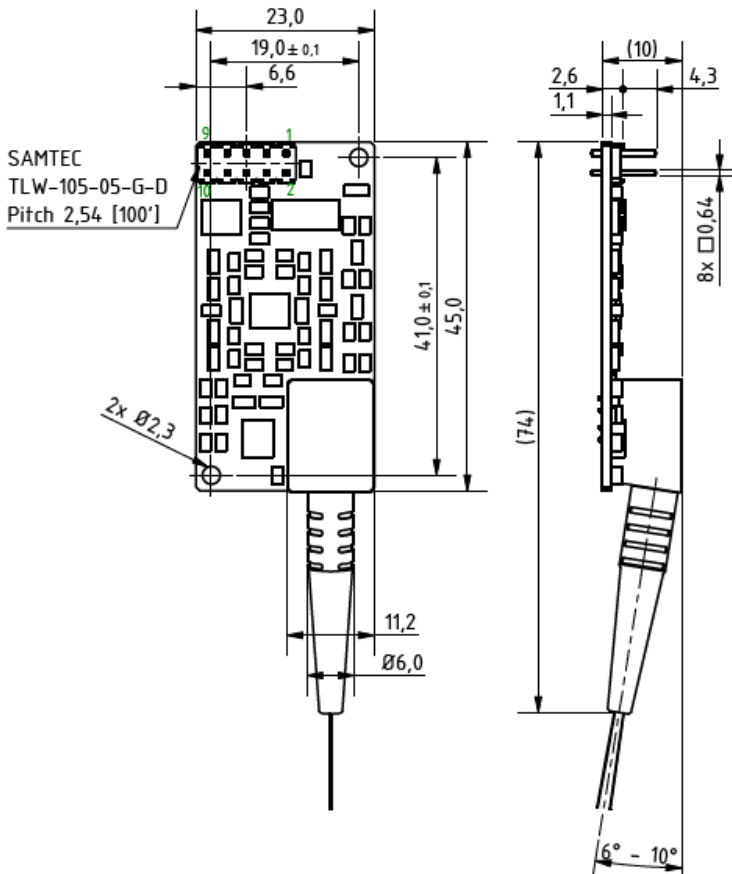


## BCTF – BARE OPTICAL COMPONENT (DIMENSIONS IN MILLIMETERS)



| Pin number | Description      |
|------------|------------------|
| 1          | Not connected    |
| 2          | Not connected    |
| 3          | Y+               |
| 4          | Not connected    |
| 5          | X-               |
| 6          | Y-               |
| 7          | Common reference |
| 8          | X+               |

## TF – WITH CONTROL BOARD (DIMENSIONS IN MILLIMETERS)



| Pin number | Description                       |
|------------|-----------------------------------|
| 1          | Ground (GND)                      |
| 2          | Supply voltage (V <sub>DD</sub> ) |
| 3          | Reserved                          |
| 4          | UART Tx                           |
| 5          | Reserved                          |
| 6          | UART Rx                           |
| 7          | Reset (/RST)                      |
| 8          | SMBus/I <sup>2</sup> C SDA        |
| 9          | SMBus/I <sup>2</sup> C SCL        |
| 10         | Ground (GND)                      |

# TUNABLE FILTER OPERATING PRINCIPLE

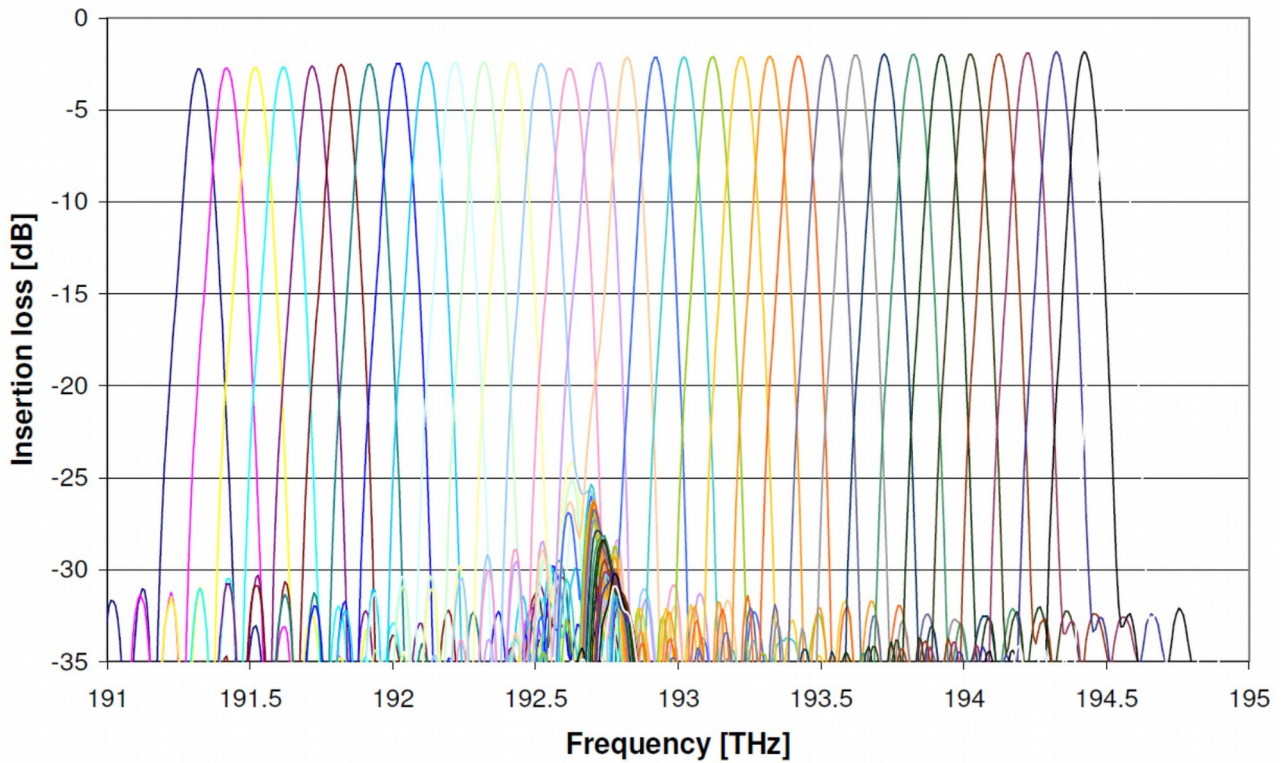
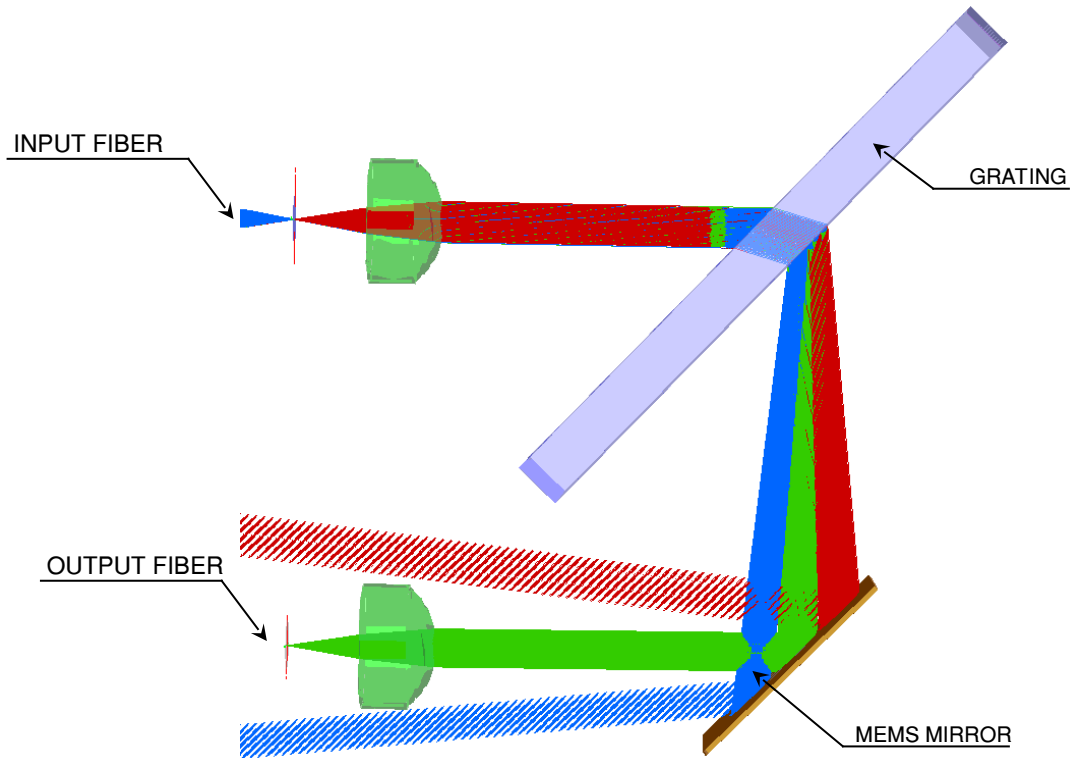


Figure 1 – Example of custom grid: 100GHz spacing, 32 channels

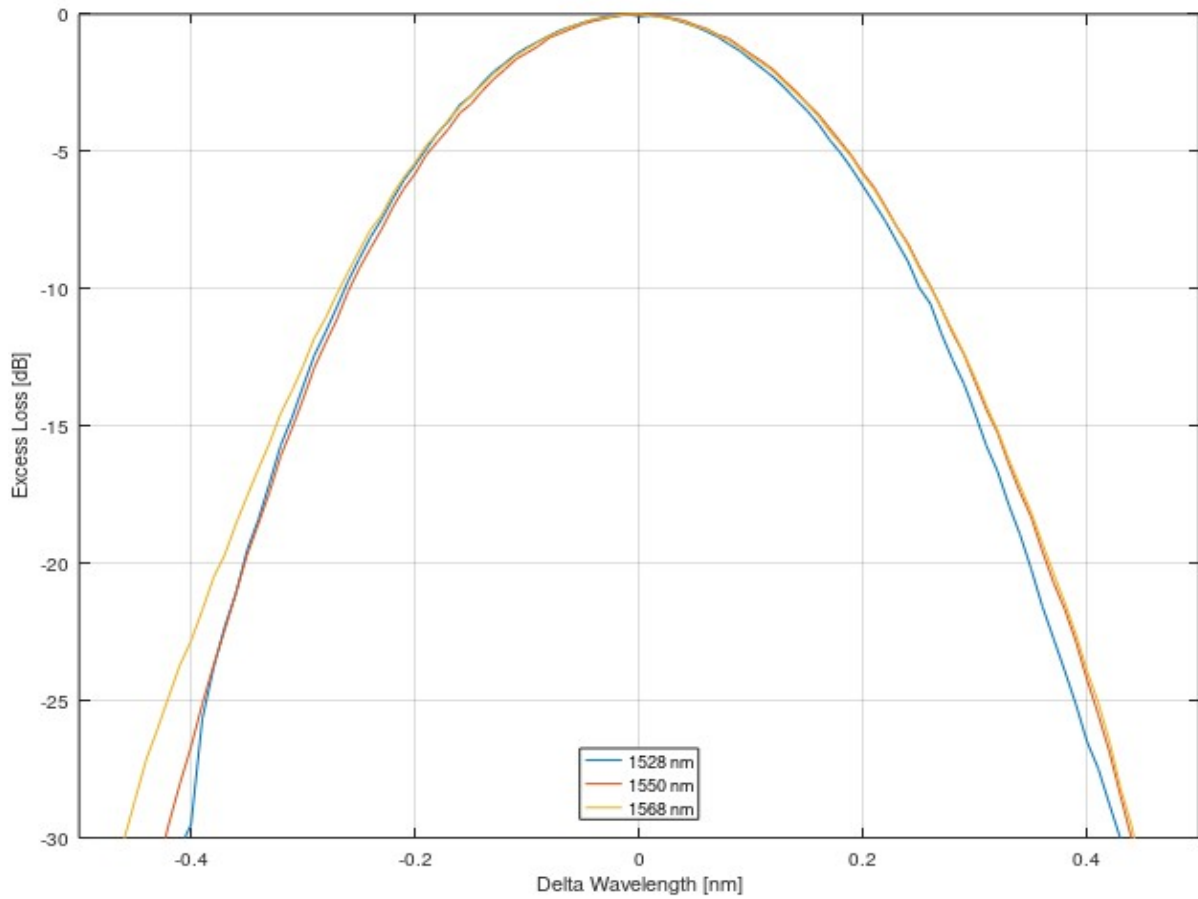


Figure 2 – Typical filter shape (50 GHz, C band variant)

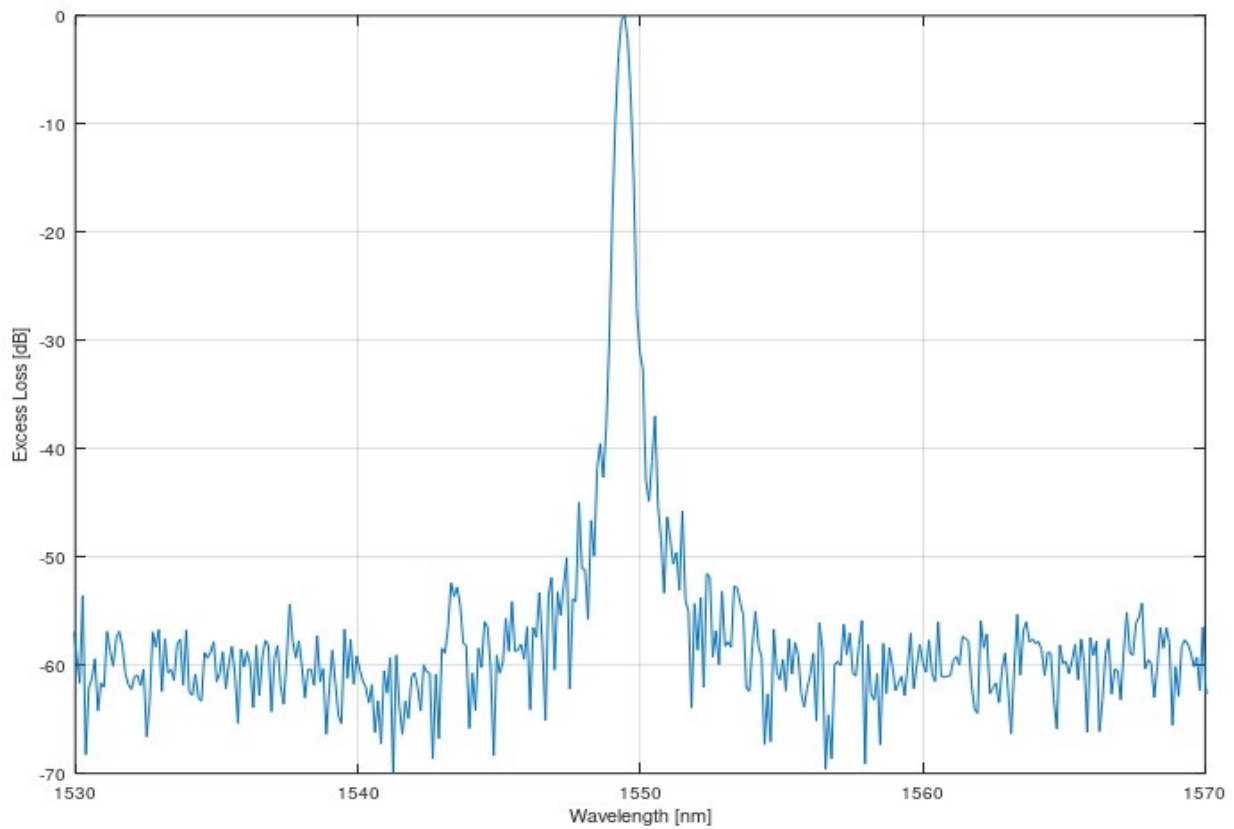
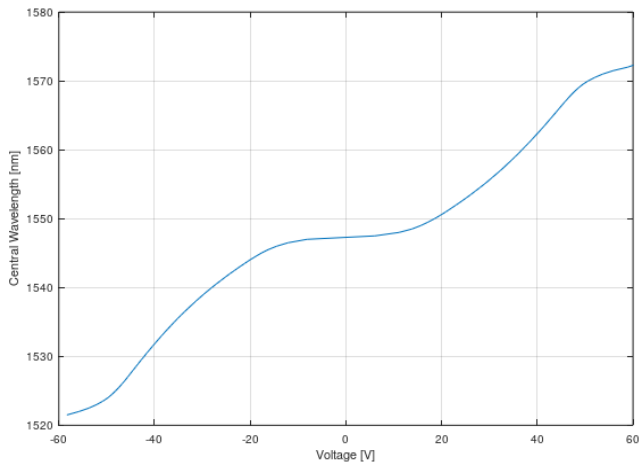
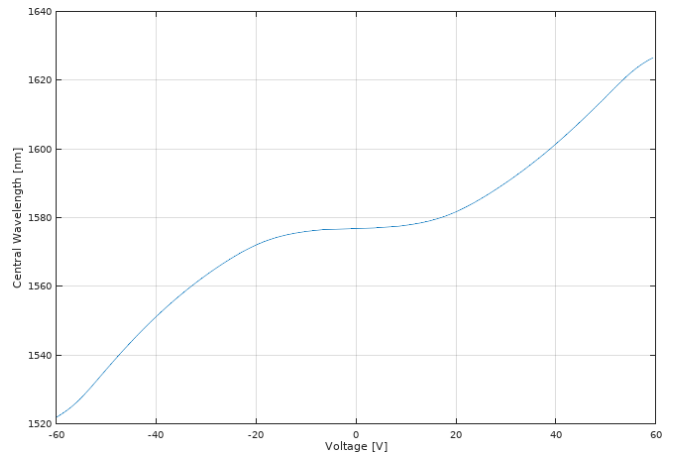


Figure 3 – Typical filter shape over the whole tuning range (C band variant)



**Figure 4 – Typical Central Wavelength vs. Voltage (C band variant)**



**Figure 5 – Typical Central Wavelength vs. Voltage (C+L band variant)**