



**Wainwright Instruments
GmbH**

Widdersberger Str.14
D82346 Andechs, Germany
Tel.: +49-8152-918230 Fax: +49-8152-918255
E-Mail: info@wainwright-filters.com
Internet: www.wainwright-filters.com

Technical Information

Return Loss, VSWR, Passband Ripple & Flatness *are all measurements of the Reflection of a filter.*

Example: 14 dB **Return Loss** = 1.5 : 1 **VSWR** = 0.18 dB **Passband Ripple**.
For us it is most convenient to measure RETURN LOSS.

Return Loss

The **Return Loss** test results listed in our filter test sheets always show the worst point measured anywhere in the passband.

When we have quoted a Return Loss of 14 dB min. we normally design for 20 dB. This usually results in a filter of approx. 16 to 18 dB Return Loss over most of the band, but it may be 14 to 15 dB somewhere in the passband.

Flatness

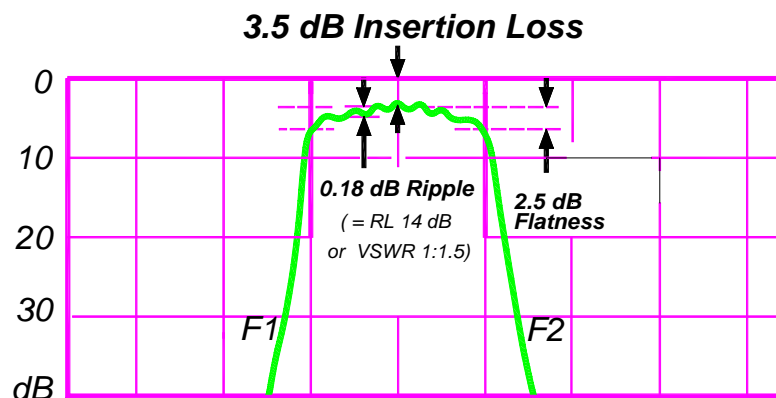
There is often confusion about the difference between RIPPLE and FLATNESS (or you could call it UNFLATNESS). RIPPLE is a variation of the passband loss due to some of the signal being reflected rather than being passed through the filter to the load. FLATNESS is mainly a variation of the insertion loss due to the losses of the filter inductor and capacitive components. Such losses are always greatest at the band edges.

A Bandpass Filter response is normally somewhat rounded, with the lowest loss in the middle of the pass band.

A Lowpass Filter has nearly zero loss at DC but increases in linear function to the end of the passband, which is usually specified as the maximum insertion loss allowed. The unflatness of the filter is equal to the insertion loss PLUS the ripple.

Sometimes filters are designed for relatively high Passband Ripple (poor VSWR) because this may result in smaller dimensions and save costs. However, our filters have normally negligible Ripple (0.18 dB max.), whereas insertion loss varies between 0.5 to 3 dB.

This curve illustrates
the difference
between
Ripple and Flatness:



RL-VSWR.doc